Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

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Note.—Initialled abstracts are written by the following:

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* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. V, No. I.

Part I. British Empire

STATISTICS 519

1. WISHART, J. 519:63.0015
Statistics in agricultural research.
J. R. Stat. Soc. (Suppl.) 1934: **1**: 26–61.

In an introductory historical commentary the author traces the evolution of field experiments from the single plot technique as introduced by Sir John Lawes at Rothamsted in 1839 to the complex replicated layouts of to-day.

The mathematical laws and methods, on which the statistical reduction of the data depends, are then set out and by means of a simple example of an agricultural experiment on two types of seed drill, it is demonstrated how the analysis of variance technique, as introduced by R. A. Fisher, simplifies the problem of analysing the data and testing the significance. The flexibility of the technique is further exemplified in the randomized blocks, Latin square and more complex layouts. The theory of the analysis of covariance, a more recent development, is then described and by means of illustrations from actual experiments its use as a valuable statistical tool is proved.

Statistical methods are next applicable to the problem of sampling and an exposition of a few cases in which one is compelled to sample, as an alternative to handling the entire bulk of the experimental material, shews the importance of the problem.

Finally statistical methods may be of great use in determining the effect of various weather factors on crops, where long records of yields and comparable meteorological data have been kept.

Although the samples are agricultural in nature, the author throughout attempts to shew by implication how the statistical methods described may equally well be applied in other types of experimentation. G. B. L.

2. VAIDYANATHAN, M. 519.24
The method of "covariance" applicable to the utilization of the previous crop records for judging the improved precision of experiments.
Ind. J. Agric. Sci. 1934: **4**: 327–42.

The possibility of improving the design and increasing the precision of new experiments on the basis of preliminary yields is discussed.

A combination of the method of "equalizing plot yields" and R. A. Fisher's randomized block layout in preliminary trials, seems to give considerable guidance in the design of new experiments. An efficient statistical method of actually adjusting experimental yields on the basis of preliminary yields is then provided by the "analysis of covariance" technique. Comprehensive tables are constructed to demonstrate all stages of the calculations and the gain in precision by the use of this method is shewn in an example. (See also "Plant Breeding Abstract," Vol. IV, Abst. 525.) G. B. L.

GENETICS 575

3. BARTLETT, M. S. and HALDANE, J. B. S. 575.123:519:576.356.5
The theory of inbreeding in autotetraploids.
J. Genet. 1934: **29**: 175–80.

Expressions have been found for the rate of decrease of heterozygotes when brother and sister are mated in a tetraploid species and various methods of building up a pure line are compared.

CYTOLOGY 576

4. STONE, L. H. A. 576.35:537.531

The effect of X-radiation on the meiotic and mitotic divisions of certain plants.

Ann. Bot. Oxford. 1933: **47**: 815–26.

The effect of X-radiation on the meiotic divisions in *Tulipa silvestris* and *Rhoeo discolor* and on the mitotic divisions in *Crocus Olivieri* was examined.

No immediate effect on the meiotic divisions was observed but later abnormalities involving the collapse and even disintegration of the chromosomes occurred. If the treatment was applied some time before metaphase the final stages were normal.

The effect on the mitotic divisions was first to check divisions not already begun and when these took place they were abnormal and fragmentations and translocation occurred.

The meaning of these results is discussed with special reference to Goodspeed's work on *Nicotiana* and the author suggests that the difference in the speed of the meiotic and mitotic divisions will explain their differences in reaction.

BOTANY 58

5. 581.143.26.03

Vernalization: a new method of shortening the vegetative period of plants.

Gdnr's. Chron. 1934: **95**: pp. 117, 183–84.

A survey of the methods and results so far obtained with a concise bibliography covering the work done from 1920 to 1933.

6. HAIGH, J. C. 581.143.26.03

Vernalization.

Trop. Agriculturist 1934: **82**: 214–16.

A useful summary of information on the principles and methods of vernalization as described in the Bulletin of the Imperial Bureaux of Plant Genetics. (See " Plant Breeding Abstracts," Vol. III, Abst. 554.)

FIELD TESTS 631.421

7. 631.421
519.2

DENNETT, J. H.

The layout of field experiments.

Malayan Agric. J. 1934: **22**: 276–83.

An exposition of the principles underlying the layout of field experiments and the statistical analysis of the results is given. Soil variation in particular, but likewise, damage from diseases and pests make simple and systematic layouts quite unsuitable and it is shewn how the randomized block and Latin square arrangements make for greater accuracy. In the statistical analysis of the results, not only the mean, but also the variation of the data is taken into account, and the advantages of the experimental layout are used in the analysis of variance technique. Investigations as to the optimum size of a plot which will allow of a standard error of about 10 per cent are suggested. A table shews how little the standard error is reduced by increasing the number of replications beyond five.

Due to the marked effect of seasons, experimental results must be interpreted with caution.

G. B. L.

8. 631.421(014)
519.24(014)

WISHART, J.

Bibliography of agricultural statistics, 1931-33.

J. R. Stat. Soc. (Suppl.) 1934: **1**: 94–106.

The bibliographies of agricultural statistics supplied yearly since 1931 to the Royal Statistical Society Watch Committee which was set up to report on statistical papers are here combined. The 157 papers listed, all except the first published between 1931 and 1933, are concerned with the application of theoretical statistical methods to agriculture. The list has been compiled with a certain amount of discrimination and the more important papers have a line or two added by way of condensed abstract of the contents. G. B. L.

9. WISHART, J. 631.421:519.24
Field experimentation: the modern technique.
Agric. Prog. 1934: **11**: 149–56.
A lecture delivered at the summer meeting of the Agricultural Educational Association at Cambridge in 1933. The modern technique, based on the application of statistical methods, and of the analysis of variance in particular, is described and illustrated.

WHEAT 633.11

10. 633.11.00.14(54.3)
633.63(54.3)
A summary of the important results arrived at or indicated by the agricultural stations in the United Provinces during the year 1932-33.
Agric. Sta. United Prov. Agra and Oudh. 1934: pp. 8.
The results of variety trials of wheat shewed that of the newer wheats Pusa III gave a definitely good performance though there were none markedly better than the local standard varieties. Descriptions are given of a number of Coimbatore sugar canes.

OATS 633.13

11. 633.13 Resistance
Resistance seed oats.
J. Minist. Agric. 1934: **41**: 431–32.

633.13 Resistance
Testing new varieties.
Brit. Sug. Beet Rev. 1934: **7**: p. 240.
A new oat, " Resistance," is being put on the market by the National Institute of Agricultural Botany, Cambridge, this autumn. Its yield exceeds that of " Grey Winter " by 32 per cent under suitable conditions.

MAIZE 633.15

12. 633.15:575(68)
633.15–2.112:575
The breeding of a new maize variety.
Fmg. S. Afr. 1934: **9**: p. 228.
A note on a new variety of maize, the first to be bred by the synthetic method at the Potchefstroom School of Agriculture.
Of the same type as Potchefstroom Pearl it matures about a week earlier and is more drought-resistant than any other variety hitherto tested. It is very free from suckers and seed should be available for distribution in another two years.

MILLETS AND SORGHUMS 633.17

13. RANGASWAMI AYYANGAR, G. N. and ACHYUTHA WARIAR, U. 633.17:581.162.3
Anthesis and pollination in ragi, *Eleusine coracana* (Gaertn.), the finger millet.
Ind. J. Agric. Sci. 1934: **4**: 386–93.
The complete emergence of the inflorescence takes about ten days and flowering extends over seven or eight days. In curved panicles anthesis takes place from 2 to 5 a.m., in panicles with open spikes, from 1 to 3 a.m.
The general tendency in a spike is for the opening of the flowers to progress from top to bottom whilst within the spikelets the order is reversed and proceeds from bottom to top. The rapid anthesis favours self-pollination though cross-pollination may occur very occasionally. B. P. P.

14. VENKATRAMAN, S. N., SUBRAMANIAM, P. and SOMAYYA, M. 633.174:581.02(54.8) 633.174:575(54.8)
Environmental and genetic influences on the sorghum crop at Nandyal.
Madras Agric. J. 1934 : **21** : 165–73.
This is a statistical study of the sorghum crop on the Nandyal farm conducted with the object of ascertaining the potentialities of the various methods used to increase yield. The study is practically confined to the single, compact-headed yellow type which is alone grown in the tract and is known as *Patcha jonna*. The crop is shewn to be very sensitive to environmental influences; especially marked are border effects and the effect of spacing. Prominent in giving a yield response are artificials, poudrette and cattle manure but the amount of the latter required renders the method uneconomic. Varieties offer a less important method and suffer further from the fact that the high yielders have generally an unacceptable grain. Seasonal variation is high in the crop but variation due to controllable influences such as the above compares favourably with it and suggests the possibility of maintaining moderately high yields irrespective of season by intensive methods. H. M. L.

15. 633.177–2.5–1.521.6:575
Witchweed-resistant Kaffircorn.
Fmg. S. Afr. 1934 : **9** : p. 215.
Two varieties of Kaffircorn resistant to witchweed *Striga lutea* bred at the Potchefstroom School of Agriculture are now sufficiently pure for seed production and distribution.
A number of other and probably better varieties are being tested.

RICE 633.18

16. 633.18:575(54.8)
RAMIAH, K. 633.18–2.484–1.521.6
Rice research in Madras.
Current Sci. Mysore 1934 : **3** : 34–36.
An outline is given of the development of rice improvement in Madras by the introduction of new varieties, selection and hybridization and certain elementary genetic principles are explained. One early maturing strain and two others obtained from a Coimbatore rice crossed with a local strain, korangu samba, have proved resistant to *Piricularia oryzae*.
The present general trend of breeding work and the difficulties due to sterility and chromosome aberrations, etc., are mentioned.

17. KADAM, B. S. and PATIL, G. G. 633.18:581.162.32
Natural cross-fertilization in rice.
Agric. Coll. Mag. Poona 1933 : **25** : 53-61.
Observations on natural crossing in a number of varieties of rice during the seasons 1931 and 1932 shewed that the incidence might vary from 0.00 to 4.306 per cent, and that varietal and climatic influences may determine to some extent the amount of natural hybridization in rice. Under Karjat conditions natural hybridization varied in different varieties and from season to season, the average amount being about a half per cent and the aggregate amount so low that genetic contamination is negligible.
The possible cause of natural crossing in rice is tentatively considered.

18. ANANDAN, M. and KRISHNASWAMI, V. 633.18:581.162.5:575.242
" Barren-sterile "—a new mutant in rice and its inheritance.
Current Sci. Mysore 1934 : **3** : 21–23.
A mutation is described, probably of a simple recessive gene, resulting in the production of barren-sterile plants with leafy shoots instead of ear heads, increased numbers of internodes, reduction of variation in internode length, and shorter leaf blades. The affected plants are also smaller and have fewer tillers than normal.

19. 633.18.00.14(88)
CODD, L. E. W. 633.18–2.19–1.521.6
Padi variety trials conducted during 1933.
Agric. J. Brit. Guiana. 1934: **5**: 36–38.
The results of trials of six selected padi varieties are reported. In addition varietal differences in susceptibility to "man rice" disease were noted, No. 79 being definitely more resistant than the other varieties tested.

ROOTS AND TUBERS 633.4

20. TENNENT, R. B. 633.42–2.411.1–1.521.6
The Bruce club-root resistant turnip.
N.Z. J. Agric. 1933: **47**: 297–301.
A number of tests are reported on the yield and resistance to club-root of the Bruce turnip. The Bruce is a purple-top, yellow-fleshed variety but a number of green-top orange-fleshed plants occur in lines from imported seed. This latter type has now been isolated as a distinct variety also very resistant to club-root and named Wallace.
The results of extensive trials in Otago and Southland have fully justified the high opinion of the Bruce turnip both as regards yield and disease resistance provided the seed is obtained from a reliable source.

FIBRES 633.5

21. GATES, R. R. 633.51:576.16:576.356.5
The cytological study of cotton and its relatives.
Emp. Cott. Grow. Rev. 1934: **11**: 194–201.
After a brief discussion of the importance of cytological research for plant breeding, the facts already known as to the cytological condition of the cotton species of the Old and New World are reviewed.
These are still insufficient to allow of a definite conclusion as to the origin of the tetraploid American species but the evidence for secondary association points to the fact that the Asiatic cottons are modified allotetraploids derived from an ancestral species with seven chromosomes and that the American species are therefore modified octoploids.

22. KESAVA IYENGAR, N. 633.51:581.162.51
The occurrence of a type of female sterility in cotton.
Madras Agric. J. 1934: **22**: 152–53.
In a *Herbaceum* strain No. 1281 certain plants were observed which though healthy, vigorous, without any malformations of the vegetative parts and producing many flowers developed no bolls. The flowers as a rule never opened. Though the stamens were normal the staminal column was stunted, with a large number of free filaments; the pollen was normal and there was no anther sterility, but the normal club-shaped stigma standing out from the staminal column was absent and dissection shewed that the ovary was present but the style was much shortened with a thin flattened stigma at the top.

23. SEN, K. R. 633.51:677.21
Variations in the characters of cotton fibres with the progress of the season.
Ind. J. Agric. Sci. 1934: **4**: 295–319.
Three Punjab-American cottons, Early Strain, 4F and 289F were grown at Lyallpur in 1930-31 and 1931-32. In the former season which was very mild the changes observed were not so marked. About 7 or 8 pickings were made at 2-weekly intervals.
The results for seed index were rather inconclusive; lint index and ginning out-turn shewed a definite tendency to decrease towards the end of the season. There was no significant correlation between seed index and either fibre-length or fibre-maturity. Average fibre-length in 1930-31 decreased considerably in the case of Early Strain and 289F towards the end of the season whereas in the case of 4F it shewed an increase. In 1931-32, fibre-length in all varieties was

small at the beginning of the season, rose to a maximum during the middle part of the season, and ultimately fell towards the end.
Variation in maturity of fibres was found to be the direct cause of variation in fibre-weight per cm. There was a significant correlation between fibre-rigidity and fibre-weight per cm. Fibre breaking strength was found not to depend exclusively on fibre maturity; the strength per unit fibre-weight was observed to change rather irregularly during the season. Number of fibres of different lengths per seed was higher for the last picking than for the pickings during the best part of the season. B. P. P.

SUGAR PLANTS 633.6

24. COLEMAN, L. C. 633.61:575(54.8)
Development of the sugar industry in Mysore.
Bull. Dept. Agric. Mysore. 1934: Gen. Ser. No. 18: pp. 25.

The variety of sugar-cane recommended after variety trials as most suitable for the Mysore area is H.M.320, one of the seedling canes bred by the Agricultural Department. It has proved superior to practically all the outstanding canes of Java and other parts of the world. It is a vigorous cane and hardy under unfavourable conditions, responds rapidly to manuring, can stand considerable periods of drought, has an exceptionally rich and pure juice and was the best variety tested for growing as a ratoon crop.
Some new seedling varieties, however, notably H.M. 606, H.M. 607 and H.M. 609, promise under certain soil conditions to be decidedly superior to H.M. 320 in sugar per acre yield, and are being multiplied as rapidly as possible on the government farms of the area for possible distribution in 1935.
Breeding work is also being carried out to evolve varieties of high quality and yield which, unlike the standard variety H.M. 320, will grow well on gravelly and water-logged soils and also varieties which can be planted during March and April without flowering in the following October as H.M. 320 does; and a special grant has been received for breeding thick canes suitable for South India.

25. 633.61:575(94.3)
KERR, H. W. 633.61–2.3–1.521.6:575(94.3)
Recent developments in the agriculture of sugar cane in Queensland.
Emp. J. Exptl. Agric. 1934: 2: 20–28.

A section in this article gives a brief sketch of the development of cane breeding and disease control in Queensland.
In 1928 a selection of the best breeding canes from Java was brought to South Johnstone and since then the disease resistance of the progeny from desirable crosses has been studied. In 1930 a breeding sub-station was set up in the Cairns district where flowering is profuse and owing to climatic conditions a greater yield of viable seed from cross-pollinations is obtained than is possible at South Johnstone. Consequent upon these increased facilities for seed production the propagation of seedlings is now undertaken by the Mackay and Bundaberg stations at each of which approximately 5,000 seedlings are planted annually; at South Johnstone 10,000–12,000 are propagated each year.
Trials for resistance to " gumming " disease in the southern areas have resulted in the isolation of a number of highly resistant canes from a large selection of imported plant material. If the yield tests in progress for comparison with older standard varieties prove satisfactory, the new canes are expected to be of sufficient merit for propagation on a commercial scale.

26. 633.61:575.127.2:576.312.35
SINGH, T. S. N. 633.61:575.127.5:633.178:576.312.35
Chromosome numbers in the genus *Saccharum* and its hybrids.
Ind. J. Agric. Sci. 1934: 4: 290–94.

The number of chromosomes in different forms of *Saccharaum spontaneum* was found to vary from 27 to 64 pairs. Of two forms of *Saccharum Munja* collected in the Punjab, one shewed 30 bivalents and the other only 10 bivalents.

Hybrids between Vellai, a noble cane with 40 bivalents and *S. Narenga* with 15 bivalents, possessed 34 chromosomes (including both univalents and bivalents). A hybrid between Saretha (2n = 92) and *S. spontaneum* (n = 32) shewed 39 bivalents whilst another hybrid between Shakarchynia, an unclassified indigenous cane of Bihar, and a Coimbatore form of *S. spontaneum* with 32 bivalents, possessed 47 bivalents.

Intergeneric hybrids between sugarcane (P.O.J. 2725 with 106 somatic chromosomes) and *Sorghum Durra* were found to exhibit great irregularity in chromosome behaviour. One hybrid examined shewed 58 bivalents, indicating a doubling of the chromosomes derived from the sugarcane parent.

C.O. 213 which has 59 bivalents has thrown a striped sport with 62 bivalents. This striped sport has, in turn, thrown three other distinct bud sports with 58, 59 and 46 bivalents respectively. B. P. P.

27. EVANS, H. 633.61–1.421

Some preliminary data concerning the best shape and size of plot for field experiments with sugarcane.

Bull. Dept. Agric. Sug. Res. Sta. Mauritius 1934 : No. 3 : pp. 11.

This investigation was considered advisable because, in sugarcane variety trials, the usual single row plots often led to great interactions through the suppression of weakly varieties by neighbouring more vigorous growers. The data consist of the individual cane weights of 1200 adjacent stools from a uniform field of cane, a fertility map of which is given. Detailed calculations shew how the variability in weight of cane per stool can be determined and how, by dividing the field into hypothetical plots in all directions, the standard error of the mean with the number of available replications can be used to give an index of the efficiency of plots of differing size and shape. Similar comparisons are made for different sized and shaped plots in which the outer or buffer rows are discarded.

Larger plots mean lower errors, but fewer replications and thus lower efficiency. With ample land and planting material, plots 40 holes long and 5 or 6 rows wide with outer rows discarded, are suggested ; otherwise single row plots, 20 holes long, in randomized block layouts. G. B. L.

STIMULANTS 633.7

28. KOSTOFF, D. 633.71:576.356.52

A haploid plant of *Nicotiana sylvestris*.

Nature 1934 : **133** : 949–50.

The author presents a third instance of haploidy, probably androgenic, in a hybrid obtained by pollinating the F_1 hybrid from *N. tabacum* x *N. sylvestris* with pollen from *N. sylvestris* (2n = 24). The haploid is a dwarf *N. sylvestris* plant with smaller cells than those found in the diploid *N. sylvestris*. Its cytological constitution is briefly described. The possibility of parthenogenetic origin is examined and rejected as unlikely.

29. 633.71:581.331.23:576.312.35

KOSTOFF, D. 633.71:575.127.2:581.331.23

Studies on the pollen-tubes. II. The dependence between the potency of the pollen-tube growth in foreign styles and the thickness of the pollen-tubes and chromosome number.

Current Sci. Mysore 1934 : **2** : 464–66.

The role of the nucleoplasmic ratio of the pollen and of the pollen-tubes in regulating the velocity of pollen-tube growth is examined in the light of a number of intervarietal and interspecific crosses of *Nicotiana*. The data cited shew that pollen-tube thickness plays an important part in such crosses. Apparently the thicker pollen-tubes grow more slowly than thin ones. When the factor length of styles is eliminated by considering only species with approximately the same length of styles the following tendency is found : pollen-tubes from species with a higher chromosome number grow more slowly in the styles of species having a lower chromosome number than do pollen-tubes from species with a lower chromosome number when growing in styles of species with a higher chromosome number, *e.g.* a species cross A x B would be more successful than its reciprocal B x A, when A has larger chromosome number than B, because the pollen-tubes of B more easily reach the ovary of A than in the reverse cross.

RUBBER PLANTS 633.9

30. PIERIS, W. I. 633.912:581.162.32
Notes on cross-pollination of rubber (*Hevea Brasilinsis*) in Ceylon.
Rubb. Res. Sch. Ceylon. 1934: **11**: 27–31.

The morphology of the flower and the technique for cross-pollination are described.
The results though insufficient for a definite conclusion suggest that flowers of more mature trees give a higher percentage of successful pollinations than trees which have only flowered for one or two seasons.
Dry weather was found to be an essential condition for a good set and considerable variation was noticed in the results from different trees even under the best conditions.

FRUIT TREES 634

31. EASTWOOD, H. W. 634.57(94)
The Australian nut. A valuable industry awaiting development.
Agric. Gaz. N.S.W. 1934: **45**: 203–209.

In this summary of information useful to growers of *Macadamia ternifolia* seed selection is recommended as the best way of securing nuts with desirable characteristics until vegetative propagation on a commercial scale shall have become possible. Seed should be selected only from trees of vigorous and thrifty growth of regular and heavy bearing habit and producing well filled, uniformly shaped nuts, free from disease and early in reaching the stage of commercial bearing. The nuts should not contain loose kernels, nor be hemispherical in shape, since the latter do not germinate as satisfactorily as solid kernel nuts.
The way to raise seedlings is described, though definite recommendations about varieties or strains are not yet available. One rule that may safely be adopted is to select for a high proportion of kernel to shell, not forgetting, however, that the shelled nuts tend to be small and undersized. Some general information on the yields to be expected is given.

32. SARUP, S. 634.651:577.84
Sex control in papaya.
Current Sci. Mysore 1934: **2**: p. 428.

The results obtained at Hawaii Experiment Station when 22 perfectly sterile staminate papaya trees on being decapitated produced a new growth that was strictly female and the trees bore large fruits has now been confirmed at Jodhpur. From four plants all male the cluster of leaves at the top were removed so that no axillary male shoots might develop and in all four cases strictly female trees resulted. One is bearing large fruits and the three others have produced female flowers.
Though according to some observers decapitation never produces the desired result, it should be tried before cutting the male papaya.

33. MAJUMDAR, G. P. 634.651:577.84
Change of sex in the male plants of *Carica papaya*.
Current Sci. Mysore 1934: **3**: p. 39.

A comment on S. Sarup's note (see Abstract above).

34. CHEESMAN, E. E. 634.771:575
Principles of banana breeding.
J. Imp. Coll. Trop. Agric. Trinidad 1934: **11**: 132–37.

The initial problem of the investigation undertaken by the Imperial College of Tropical Agriculture in 1922 was to breed a banana which combined the good commercial qualities of the Gros Michel variety with resistance to Banana Wilt or Banana Disease, *Fusarium cubense*. The problem is still unsolved but during the course of the work a considerable number of new facts have accumulated including additions to taxonomic and cytological knowledge which are communicated in the present report.
A survey of the genus *Musa* L. has shewn that for the present purpose only the species included in the sub-genus *Eumusa* are of importance.
With regard to the relationships of the edible bananas the following tentative speculations are put forward:—

It is suggested that several of the coarser bananas of no use for export are mainly or entirely derived from *M. sapientum* L. *sensu* Roxb. ; that Gros Michel and several of the dessert bananas of the same class have been derived from *M. acuminata* Colla, with or without the admixture of species from the East ; that some Indian varieties which may have commercial possibilities have originated from unidentified species from Northern India ; that the bananas most characteristic of the South Sea islands are mainly derived from some unidentified species from that region as they appear to shew features very different from those of either *M. sapientum* or *M. acuminata*. A discussion of the varietal problem indicates the existing confusion and the need for systematic research and the methods in use at the Imperial College for the testing and identification of varieties are described. Already the list of standard varieties has reached 25, descriptions of which are in course of publication.
Cytological investigations have shewn that the necessary sterility of edible bananas is in all probability due to their triploid condition and as a triploid will therefore probably be the final aim the procedure is roughly outlined. The first result of crossing will most probably be a tetraploid and their fertility offers a greater range of possibilities to the breeder ; then crossing a tetraploid with a diploid will restore the triploid condition.
2,463 pollinations have already been made and the results of a number of crosses are recorded. Attempts to add resistance directly to Gros Michel has not yet been entirely successful as some undesirable characters of the pollen parent have also been incorporated but with the use of other pollen parents this method holds considerable promise.
The crosses with members of the " Cavendish group " have so far all proved sterile and the scale of these investigations is to be reduced. Breeding from minor varieties is in progress but more for a knowledge of the forms than with much hope of producing the desired combination.
Species crosses have also been made, many combinations are fertile and backcrosses have resulted in triploid forms some of which may prove of value. In conclusion a revised programme of research is outlined, based on the data obtained from these investigations.

35. WATES, L. A. and CAMPBELL, T. A. 634.773
Giant plantains.
J. Jamaica Agric. Soc. 1933 : **37** : 590–91.
Two further letters on the giant plantain and its origin.

VEGETABLES 635

36. SITARAMA PATRUDU, S. and KRISTNA MURTI, P. 635.6:575.127.5
Intergeneric cross in Cucurbitaceae.
Current Sci. Mysore 1934 : **2** : p. 431.
A preliminary note on a *Momordica Charantia* x *Trichosanthes anguina* artificial cross. Over 50 per cent of the pollinated flowers developed fruit. Of the seed 50 per cent germinated well, producing a normal crop. The floral and vegetative characters of *M. Charantia* were dominant. The F_1 plants were more vigorous than the female parent and were fully fertile, the fruits, which were slightly larger than those of the female parent, containing fully developed seeds which when sown to produce the second filial generation germinated well. The F_2 segregation shewed interesting combinations with gradations in form and size of fruit and in flavour.

37. SANSOME, F. W. 635.64:575.115.061.6:576.356.5
Character expression in the tomato.
Proc. Linn. Soc. Lond. 1933/34 : Part II : 41–42.
A brief note on a lecture on a comparative analysis of colour and dominance in diploid and tetraploid tomatoes. In the ensuing discussion the opportunity afforded by such experimental material for the comparison of size and colour factors in one and the same tetraploid organism was pointed out.

38. MacArthur, J. W. 635.64:575.116.1
Linkage groups in the tomato.
J. Genet. 1934: **29**: 123–33.
On the basis of a large number of observations in field and greenhouse from 1924-1933 a study was made of the mode of inheritance and of the mutual linkage relations of the 20 genes of the tomato most fully studied. Apparently the linkage relations are best explained by placing these genes in 10 of the 12 tomato chromosomes. In the provisional maps for these chromosomes no claim is made to accurate identification of the actual loci in the various chromosomes.

39. Balaji Rao, T. K. 635.646:575.12:581.162.5
Partial sterility in the first generation plants of crosses between wide varieties of the common egg plant. (*Solanum melongina*).
Current Sci. Mysore 1934: **2**: 285–86.
Using the Mysore variety of egg plant as the common male parent in four crosses with different kinds of ordinary brinjal (not named), the F_1 obtained was characterized by considerable vegetative vigour but also by partial sterility.
In the F_1 pollen 90–95 per cent of the grains were ill-developed and empty.
Cytological and other investigations are to be continued to elucidate the condition.

40. Abdur Rahman Khan and Akhtar, A. R. 635.657:575.11.061.6:581.46
The inheritance of petal colour in gram (*Cicer arietinum* **Linn.**).
Agric. Live-st. Ind. 1934: **4**: 127–55.
This is a study of simple inheritance and is suggested as a suitable study for students in Northern India who are commencing a practical study of genetics.
Since the anthers may rupture one or two days before the bud opens, emasculation must be effected early. The flowers open normally between 9 and 10 a.m. Nine of the Pusa types are concerned in the study.
The main conclusions are that blue colour is due to a single factor (B); a factor (P) gives a pink colour in the presence of (B) but is itself without colour effect; a green colour of the standard is developed in the absence of a factor (W) and 'singleness,' which term implies a peduncle with only one flower, is due to a factor (S) dominant to 'doubleness.'
The large number of tabulated analyses of the F_2 generation indicate independence of these factors. H. M. L.

41. Jagannatha Rao, C. and Subramanyam, P. 635.657:581.162.51
A note on the occurrence of sterility in Bengal gram. (*Cicer arietinum.*)
Madras Agric. J. 1934: **22**: p. 187.
Continuing the observations previously recorded (see "Plant Breeding Abstracts," Vol. IV, Abst. 984) seed from sixteen apparently normal (non-sterile) single plants of culture 176 was sown in individual lines in 1933-34 and of these sixteen progeny lines six produced normal plants and the remaining ten segregated into normals and steriles. The latter which could be identified at very early stages are relatively late in flowering and, though vigorous, none set seed. Moreover in them the structure corresponding to the ovary contains "minute stamen-like organs and some green bodies." No fungus could be found in sections of either the flowers or leaves.
The inheritance of this form of sterility is to be studied in larger populations from some segregating groups of plants.

Part II. Foreign

STATISTICS 519

42. YATES, F. 519.24
The analysis of multiple classifications with unequal numbers in the different classes.
J. Amer. Statist. Ass. 1934 : 51–66.

When the data of observation are classifiable in more than one way the statistical analysis presents special problems. With equal numbers in the various sub-classes the procedure is simple, and is a special case of the analysis of variance procedure of Fisher. This paper deals with the general case of unequal numbers in a p x q table, and a detailed account of the methods of analysis and of the logical principles underlying them is given. A special case of analysis in a 2 x *s* table by Brandt is referred to and it is shewn that certain corrections in Brandt's methods are needed. J. W.

43. BROWN, H. M. 519.24
Tables for calculating the standard error and the probable error of the coefficient of variability.
J. Amer. Soc. Agron. 1934 : **26** : 65–69.

The two tables provided do away with the necessity of resorting to the basic formulae for the calculation of the standard error (S.E.) and probable error (P.E.) of the coefficient of variability (C.V.). The first table gives A for values of C.V. from 1 to 119, with first differences for interpolation purposes and $\sqrt{N}$ (where N is the number of observations) is obtainable from any book of square roots ; then S.E. of any particular C.V. is simply $A/\sqrt{N}$. The second table is similarly constructed so that P.E. of any particular C.V. is simply $B/\sqrt{N}$. G. B. L.

GENETICS 575

44. 575.1
HAGEDOORN, A. L. 633:575
Pflanzenzüchtung und Tierzucht aus genetischem Gesichtspunkt. **(Genetic aspects of plant and animal breeding.)**
Z. Züchtung 1934 : A **19** : 414–28.

The development of plant breeding and the various conceptions that have prevailed of its relations to genetics are outlined, and the value of co-operation between the experienced geneticist and the plant breeder is emphasized and exemplified by the advances that have been made following the introduction of progeny tests and selection according to the genotype.

45. HERSH, A. H. and FELDSTEIN, M. J. 575.1:519
On the determination of genetic constants of relative growth.
Amer. Nat. 1934 : **68** : 72–73.

A comparison is made of the results obtained by two methods of applying the method of least squares in estimating the differences in the constants of relative growth brought about by relatively small genetic differences.
Though the two methods give somewhat different results no certain criterion has been yet established for deciding which of the two is preferable.

46. NAWASCHIN, M. 575.1:578.6
Die Methodik der zytologischen Untersuchungen für züchterische Zwecke. **(Technique of cytological investigations in breeding work.)**
Z. Züchtung 1934 : A **19** : 366–413.

The preparation of plant material and its examination, microtome technique, fixation, embedding, mounting, etc., are all described in considerable detail and a bibliography referring to special points in the discussion is given.

47. WRIGHT, S. 575.115:576.12
Physiological and evolutionary theories of dominance.
Amer. Nat. 1934 : **68** : 24–53.

Following a consideration of the statistical principles of dominance, the physiological explanations of dominance are discussed under the following heads : the factors of development ; the chain of reactions between gene and character ; mathematical theory ; multiple allelomorphs ; all or none reactions ; modifying factors ; direct evidence of the nature of dominance.
The statistical results of gene physiology, the effects of selection and its evolutionary implications are then examined and general conclusions are outlined.
The measurement of dominance in the study of the effects of gene substitutions in every possible genetic and environmental background provides a most useful tool in tracing the genetic physiology of characters.
An extensive bibliography is included.

48. 575.127
KARPECHENKO, G. D. 575.127:633:575
(Investigation of distant hybridization of plants in the U.S.S.R.)
Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 41–50.

The great possibilities, and also the difficulties, of the method of distant hybridization are briefly touched upon, whereupon mention is made of various methods whereby these difficulties may be overcome. For instance, failure in making oat crosses has sometimes been overcome by working in a more sheltered place, the pollen being very susceptible to drying ; in cotton crosses special measures to prevent the premature bursting of the style have often resulted in success in interspecific crosses where the pollen tube travels very slowly ; where one cross is a failure the reciprocal may be quite successful ; great differences have been found to exist between races within the parental species in the ease with which they cross with another species. Michurin claimed that grafting one species of fruit tree on to the other is a means of partially overcoming their crossing incompatibility. The author finds that this is achieved in some plants by chromosome duplication, as in the case of the tetraploid cabbage ; the percentage success obtained by crossing the diploid and tetraploid cabbage with various other species and genera are tabulated. From this it is seen that it is not the equality of the chromosome numbers that is the deciding feature, since the 36 chromosome tetraploid also crosses with much more ease with *Brassica chinensis* (2n = 20) than does the 18 chromosome diploid. Some of the hybrids with the new *Brassica* are very luxuriant in growth and may be useful for silage. Observations on a number of constant fertile hybrids have shewn that the fertility is dependent upon the possibility of regular pairing resulting from the duplication of every chromosome in each parental set, though genes may be present which cause sterility even when the full chromosome complement of each species is present. Various ways in which chromosome duplication may be effected are enumerated, including the wheat-rye hybrid of Lebedev with intermediate chromosome number, resulting from fertilization of a somatic gamete by rye, followed by autosyndesis accompanied by the loss of one wheat genom in the hybrid and the production of a constant hybrid. Chromosome duplication in hybrids of nearly allied species on the other hand, *e.g. Vicia sativa* x *V. macrocarpa*, leads to the formation of tetravalents and consequent sterility.
Intensive efforts are now being made to effect the duplication of the chromosomes artificially, by the use of an improved form of the callus method, abnormal temperatures and various narcotics, etc. Among the objects under experiment are hybrids of *Gossypium hirsutum* x *G. barbadense*. Crossing with a third species constitutes a further method and if the third species has double the chromosome number of the hybrid and the latter forms unreduced gametes, triple hybrids may be formed which are stable cytologically but genetically heterozygous. In this way triple hybrids have been obtained of various tobacco species, of (*Triticum dicoccum* x *T. monococcum*) x *T. vulgare* and (*T. durum* x *Secale cereale*) x *T. vulgare*, the latter having 20 per cent fertile pollen. There is now direct evidence that processes of this kind have played a part in the evolution of species in nature.

Emphasis is laid on the fact that even in the ordinary course of segregation in hybrids of species differing in chromosome number certain characters have been transferred from one species to the other and new types not entirely sterile have emerged, the results indicating that not only has there been interchange between the chromosomes of the two parent species but between different chromosomes within one of the species. Constant and fertile intermediate forms with various intermediate chromosome numbers have been observed by Sapehin and by Sorokina in interspecific and intergeneric crosses with wheat, and by Sveshnikova in crosses between *Vicia sativa* with 6 chromosomes, 4 large and 2 small, and *V. amphicarpa* with 5 large chromosomes. Here, as in Ivanov's crosses of *Avena barbata* and *A. sativa*, new forms appeared and also a number of mutants never observed in the parental species. The same has been observed in crosses of wheat with *Agropyrum* and many other crosses and the Soviet geneticists are now embarking upon an exhaustive study of the laws governing the behaviour of these wide crosses and the inheritance of characters in them. These studies are embracing potatoes, cotton, peas, sorghum and Sudan grass, maize and teosinte, and various horticultural plants.
Crossing between different geographical races within a species often occasions a sufficiently wide segregation without the accompanying sterility and may thus for economic purposes be preferable to interspecific hybridization. This is notably the case in crosses of different ecotypes of barley and lentils : among the motley of forms appearing in the progeny of two economically worthless forms, types of extreme interest for the breeder have been obtained, and one of the new problems of the breeder is to discover the latent possibilities of the different types at his disposal and select the best parents.

49. PEDERSEN, A. 575.143:631.531.12
Formering af Sorter og Stammer. (**Multiplication of varieties and strains.**)
Tidsskr. Landøkon. 1934 : No. 6 : 306–31.

Since the multiplication of varieties and strains must be carried out in such a way that they remain as far as possible unchanged as regards genetic constitution and the combinations in which the genetic constitutions are expressed, various methods must be used according to the particular mode of reproduction of the plant material in hand. The conditions relating to fertility and, in the case of cross-pollinated plants, self-sterility and inbreeding must be considered. The possible sources of contamination of varieties and strains having been described for (1) self-fertilizing or vegetatively reproducing plants and (2) for cross-pollinated forms, the extent of variation due to crossing in the latter forms is considered. Spacial isolation and the use of larger areas for the seed crop are recommended as a means of reducing the percentage of crosses.
The changes that may be produced in strains and varieties by alteration of the particular genetic combination and by selection are pointed out and the influence of inbreeding and the frequency of self-fertilization side by side with cross-fertilization in cross-pollinated forms is touched upon and the relevant literature cited.
The effects of self and cross-fertilization on inheritance in heterozygotes are examined in some detail, (1) for forms heterozygous for only one or two of a few factors and (2) for the more complicated heterozygotes with which the breeder has to deal. As regards the first of these two groups, it appears that with self-fertilization an approximately constant state of balance between the various genotypes is reached after the 6th, 7th or 8th generation ; whilst with cross-fertilization this condition is reached after one multiplication ; and finally where both self and cross-fertilization are operating the result will approximate to that obtained from either mode of fertilization alone, and in a degree corresponding to the extent to which these two phenomena occur respectively. As regards the second group it is shewn that with self-fertilization, after from 5–8 multiplications of the progeny from more complicated hybrids, practically speaking, almost complete homozygosity is attained. In the case of cross-fertilized plants, however, no such result can be expected after one generation since other disturbing factors such as aberrant segregation ratios, differential vitality and fertility and the possible combinations of self and cross-fertilization come into play.
Finally the practical question as to whether cultivated strains of root crops and pasture plants alter during multiplication is examined and less rigid selection of root crops is suggested as a way of obtaining greater stability and as a cheaper method in multiplication.

50. SCHICK, R. 575.24:575.11
Über einige für den Pflanzenzüchter interessante Mutanten von *Antirrhinum majus*. (**On some mutants of *Antirrhinum majus* that are of interest to the plant breeder.**)
Züchter 1934 : **6** : 30–33.

It is generally assumed that only the morphological characters are inherited on a monofactorial basis and that the economically important physiological characters besides having a complicated inheritance are much affected by the environment.
With suitable material however, such as the pure lines of *Antirrhinum majus* used by Baur in mutation experiments at Müncheberg, it can be shown that physiological characters may also show a simple inheritance.
The types in question have all been experimentally produced including two strains of plants which flower earlier than the normal and differ from them only by a single gene. A type producing double the normal number of flowers, one with greatly increased leaf breadth, another much branched type, and a dwarf are described, all of which behave as simple recessives and the suggestion is made that similar forms might be produced in plants of economic value and it is hoped that the work may be extended in this direction.

51. NAVASHIN, M. and SHKVARNIKOV, P. 575.24:581.036
(**The acceleration of the process of mutation in seeds by increased temperature.**)
Priroda (Nature). 1933 : No. 10 : 54–55.

See " Plant Breeding Abstracts," Vol. IV, Abst. 1.

CYTOLOGY 576.3

52. BLAKESLEE, A. F. 576.312
New Jimson weeds from old chromosomes.
J. Hered. 1934 : **25** : 81–108.

A popular account in simple language of the cytological investigations on the Thorn-apple, *Datura stramonium*, known in America as the Jimson weed.
The discovery and interpretation of primary, secondary and tertiary types are described and the methods for synthesizing pure-breeding extra chromosomal types. The article is abundantly illustrated with photographs and diagrams.

53. LEVITSKY, G. A. 576.312:63.00.15(47)
(**Soviet cytology applied to plant industry during recent years 1928-1933.**)
Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 25–39.

Following upon a brief mention of the various cytologists now working in the U.S.S.R. the author refers to his own studies on the morphology of the chromosomes by the use of his special fixative, which has displayed the chromosomes of even well-known objects in a completely new light.
Figures are given illustrating the difference between the old method and the new, whereby not only the size of the chromosomes can be fairly accurately measured but their actual morphological characteristics made manifest. By this method the same sort of " two-limbed " articulation has been shewn to be common to the whole of the plant and animal kingdoms.
The examination of an entire subfamily has demonstrated the existence of differing degrees of stability of the karyotype, *i.e.* of different intensities of the karyo-evolutional processes in different sections or genera of the family.
The common wild *Vicia narbonensis*, thought to be the progenitor of *V. Faba*, proved to have chromosomes much less reduced in one limb than the latter species. On further search, however, individuals were found within *V. narbonensis* with reduced limbs in all but one chromosome, almost exactly corresponding to the karyotype of *V. Faba*.
In polyploid *Aegilops* species whole chromosome sets have been identified and shewn to be derived from other species, which has led to the artificial production of the polyploid species

and an entirely new foundation for the systematics and phylogeny of the genus (see " Plant Breeding Abstracts," Vol. III, Abst. 393).

The changes which the chromosome apparatus undergoes in the course of evolution have now become the main subject of investigation in the author's laboratory. It has been shewn that duplication (polyploid) changes in the chromosome number can occur in systematic units of the lowest order—varieties and subvarieties. Such duplications represent a very minor stage in the evolutionary process. The alteration of the basic chromosome number represents the main line of evolutionary change, these basic chromosome numbers constituting the difference between the tribes, within which they are with very few exceptions constant. In the *Gramineae* this change has occurred in the direction of a dimunition of the basic number from 12 or 10 down to 7 or 5 in the most recent and advanced species, which change has been accompanied by an increase in the size of the individual chromosomes.

Reference is made to a series of works on the extra chromosomes in various cereal genera, to interspecific and intergeneric cereal hybrids, to experiments on the influence of X-rays on the behaviour of the chromosomes, and the production of amphidiploid hybrids from two and more species or genera. The work of the Timiriazev Biological Institute under Navashin, of Delaunay on the influence of X-rays and low temperature on the chromosomes, of Sapehin on the genes governing the reduction division, of Sveshnikova on intraspecific chromosome differences in *Vicia* and the production of a constant rye-wheat hybrid with intermediate chromosome number by Lebedev are all referred to, together with the work of various other Soviet geneticists of less note.

54. 576.354.4:539.16
635.651:576.354.4

MATHER, K.

The behaviour of meiotic chromosomes after X-irradiation.

Hereditas 1934 : **19** : 303–22.

A comparative study of the behaviour of the chromosomes in *Vicia Faba* and *Tradescantia bracteata* immediately after X-irradiation was expected to throw light on the nature of the differences between somatic and reduction divisions and on the chromosome forces in operation at these two periods.

The chief effects of irradiation were to cause :

(*a*) in divisions occurring soon after irradiation much fragmentation of the chromosomes (a tendency subsequently lost), before metaphase in *Tradescantia bracteata* and at late metaphase and anaphase in *Vicia*. This difference between the two species is attributed to differences in the forces which also cause terminalization of their chiasmata ;

(*b*) persistent major structural changes in the chromosomes in both organisms, an observation which considered with (*a*) above is regarded as implying the existence of two distinct parts in the chromosomes ;

(*c*) increased frequency of chiasma formation in nuclei at meiosis some time after treatment.

Further work on these problems is in progress.

BOTANY 581

55. 581.162.5

UBISCH, G. v.

Das Fertilitätsproblem im Pflanzenreiche. (**The fertility problem in the plant kingdom**).

Z. indukt. Abstamm. –u. VererbLehre. 1934 : **67** : 225–41.

In heterostylous forms self-sterility, self-fertility and cross-fertility are considered and an attempt is made to define sterility from the genetic standpoint by considering the views of Lehmann and East, and Laibach and Ernst on the relations between fertility and heterostyly and also the role of pollen size. The evidence tends to shew that fertility always obtains in cases where a style homozygously recessive in constitution meets with heterozygous pollen

and also where a heterozygous style encounters homozygously recessive pollen. In other cases sterility occurs.

The views and evidence of various workers on the physiological aspect of the mutual relationship of the factors in fertility are then discussed with special reference to the problem of the dependence of the effectiveness of the haploid pollen grains upon the diploid organism, the mother plant. Here previous workers' theories on cytoplasmic effects in inheritance and on inhibitory action in cross-pollination are mentioned : and an attempt is made to correlate the various findings on inhibitory action and pollen tube growth and the genetic constitution of the pollen and styles with recent work on growth substances.

Part II deals with fertility in dioecious plants and the correct interpretation of the complete self-fertility observed in any hermaphrodites found in dioecious forms. The writer's observations on the sex ratio in *Antennaria dioica* are considered with reference to the growth promoting factor postulated by various investigators as present in the pollen grain ; and she further suggests the existence of a similar factor in the style which facilitates the growth of grains also possessing it. Linkage, not complete, between this growth factor and the sex factor *F* can, it is claimed, explain the deviations from the normal sex ratio.

The validity of applying these results with *A. dioica* to other dioecious plants is considered ; and a tentative theory is formulated of a fertility or a growth promotion factor linked with *F*, occurring in a multiple allelomorphic series, though at present detectable only by the sex ratios obtained.

AGRICULTURE 63

56. KELLER, B. A. 63.0015:581(47)

(The Botanical Institute of the Academy of Sciences SSSR at the 17th Congress of the Communist party.)

Sovetskaja Botanika (Soviet Botany) 1934 : No. **1** : 3–13.

An account of the reconstruction of the Botanical Institute and the achievements, in the form of researches and publications on the local flora and expeditions to study it, as reported to the seventeenth congress. " Sovetskaja Botanika " is the organ of the Botanical Institute.

57. MCCLELLAND, C. K. 631.421:633.1

Border rows of oat plats as affecting yields and variability.

J. Amer. Soc. Agron. 1934 : **26** : 491–96.

The inclusion of border rows in plot tests was found to add from 4–8 per cent to the yield obtained from the interior rows.

FIELD TESTS 631.421

58. THOMPSON, R. C. 631.421:633.492

Size, shape and orientation of plots and number of replications required in sweet-potato field-plot experiments.

J. Agric. Res. 1934 : **48** : 379–99.

This is a uniformity trial study in which the data are analyzed statistically by the methods first put forward by Wood and Stratton. The material is taken from four plantings of sweet potatoes grown in 1929 31. Increasing the size of individual units gave a significant reduction in the standard deviation of plots up to about 90 linear feet of row. Multiple row plots were less variable than single-row plots of the same total row length and area. Variation among plots decreased as the plot shape approached a square, the influence of plot orientation being at the same time shewn to be important. No one plot size can be stated to be most desirable in sweet potato field experiments, this being related to the number of replications given. A satisfactory arrangement is to use a plot consisting of 90 linear feet of row replicated 4 or 5 times. J. W.

PLANT DISEASES 632

59. TASUGI, H. 632.411.4:576.16:633.171

[On the life-history, pathogenicity and physiologic forms of *Sclerospora graminicola* (Sacc.) Schroet.]

J. Agric. Exp. Sta. Tokyo 1934 : **2** : 345–66.

On the basis of slight differences in the size of the oospores and of clear differences in pathogeneity of four strains derived from *Setaria* species, four biological forms of the fungus are distinguished.

60. Bauch, R. 632.451:575.127.2:577.8
Über Kreuzungen zwischen bipolar und multipolar sexuellen Brandpilzarten. **(On crosses between bipolar and multipolar sexual species of smut fungi.)**
Z. indukt. Abstamm. –u. VerebLehre. 1934: **67**: 242–45.
It is the author's contention that the tendency to compare the phenomena of multipolar sexuality of the smut fungi with the genetical basis of sexual differentiation in other organisms with haplogenotypical sex inheritance and to homologize the sex factors with the α and γ realizators is unjustified.
A closer examination reveals great difficulties in the way of such a theory and the experiments made shew that there is a wide difference between the two sets of phenomena. Crosses were made between bipolar and multipolar species of smut fungi and the results shewed that the sterility factors of the multipolar species differ from each other and are specific for each species, and the conclusion is drawn that they are phylogenetically younger than the sex factors.
From the results of crosses between bipolar species and between multipolar species the author concludes that in the bipolar species the sex factors are of very different value and cannot be identified with each other. In principle the apparently arbitrary exchange of the sex factors in the multipolar species has already begun in the bipolar species and there is no sharp distinction between the two kinds of sexuality.
The genetical basis of the sexuality of smut fungi and probably also of the *Hymenomycetes* therefore is completely dissociated from the haplogenotypical sex inheritance from which bisexuality develops.

61. Bever, W. M. 632.452.*P. glumarum*.11:576.16:633.11
Physiologic specialization in *Puccinia glumarum* in the United States.
Phytopathology 1934: **24** 686–88.
A preliminary note on certain evidence for the existence of a second physiological form of *P. glumarum*, discovered for the first time in the United States.

62. Tu, C. 632.452:576.16.633.11
Physiologic forms of *Puccinia graminis tritici* in Kwangtung, Southern China.
Phytopathology 1934: **24**: 423–24.
Other methods of control of black stem rust of wheat *Puccinia graminis tritici* being impracticable in China, the breeding of resistant varieties must be studied, and as a preliminary an investigation of the amount of physiological specialization was undertaken.
Six physiological forms were found of which two correspond with forms 15 and 9 as described by Stakman and Levine, the other forms seem to be entirely new and would be designated as forms 132, 133, 134 and 135.

63. Sibilia, C. 632.452:576.16:633.11
Le ricerche sulla specializzazione delle ruggini del grano in Italia. **(The researches on the specialization of wheat rusts in Italy.)**
Ital. Agric. 1934: **71**: 451–57.
The three species of rust fungi, *Puccinia glumarum*, *P. triticina* and *P. graminis* are briefly described.
In view of the number of physiological forms the difficulties of breeding resistant varieties are much increased, but as all the biotypes are not present in every district it is hoped that varieties may be produced each resistant to the different forms found locally. With this aim in view the R. Stazione di patologia vegetale in Rome has constructed specially designed buildings for this type of research, of which details are given as well as an outline of the methods employed.

64. 632.452:576.16:633.174
632.452:576.16:575.12

MAINS, E. B.

Host specialization of *Puccinia Sorghi*.

Phytopathology 1934 : **24** : 405–11.

The results of these experiments indicate in confirmation of those of other workers that *Puccinia Sorghi* is self-sterile.

Oxalis corniculata proved to be the most favourable host, it was susceptible to all the collections of rust studied, producing an abundance of aecia. Most of the other species of *Oxalis* tested gave negative results, but the production of aecia on *O. europea* with two out of the eight collections indicated the presence of at least two races of *P. sorghi* distinguishable by the susceptibility of *O. europea*.

Inoculations from rust collected on maize produced uredinia on maize and teosinte, but the results on species of *Andropogon, Coix, Erianthus, Holcus, Tripsacum*, and *Sorghastrum* were negative.

ECONOMIC PLANTS 633

65. NILOV, V. I. 633:575:581.192

[The problems of breeding for chemical composition (problem and achievements).]

Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 61–65.

The author discourses upon the marked differences that are observable between plant products of apparently identical composition produced by different species and races. Wide differences are also observed in the quantity of a particular compound contained in different races and much progress can be made by breeding for high content in the case of desirable compounds, whilst equally striking results have been obtained from selection for low content of undesirable compounds such as alkaloids in lupins. Races of lavender have been found yielding 15-20 times as much essential oil per plant as the common kind, thyme giving 3-5 the normal percentage of thymol and *Taraxacum gimnantum* giving 3-4 times the yield of rubber of the ordinary form. The presence of minute amounts of certain compounds often determines the so-called quality of a given vegetable product. From this point of view also a knowledge of the variation within the species is of primary importance. The investigations so far carried out indicate that variation within a species affects the qualities of different constituents but the actual constituents present in different races are more or less constant. Intraspecific hybridization will not therefore be capable of producing new compounds, though it may frequently produce forms containing both higher and lower proportions of a given substance than the two parent varieties. In fact the author affirms that the amplitude of variation can always be enlarged in this way, provided a sufficiently large number of crosses is undertaken.

By interspecific or intergeneric hybridization on the other hand entirely new combinations of substances are produced and in the products of segregation there may appear new and unknown qualities, new essential oils for example, and hence new flavours and perfumes. Thus in hybrids of *Pelargonium radula* containing geraniol and *P. capitatum* containing citronellol segregates containing an acid hitherto unknown in the genus appeared. Similarly the segregates of the hybrid species *Mentha piperita* all differed one from the other in their particular chemical composition.

These facts suggest the possibility not only of creating new plant compounds but of synthesizing forms of one species containing the compounds characteristic of another, *e.g.* to form quinine in plants other than *Cinchona*, capable of growing in the temperate zones.

Another field that calls for further investigation is the production of mutants differing in their chemical constitution.

66. *VAVILOV, N. I. 633.00.15(47)

(Soviet scientific plant industry during the period of Soviet reconstruction 1930-1933.)

Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 5–23.

The achievements of the last three years are reviewed, reference being made to the enormous scale on which agricultural research is now carried on in the U.S.S.R. As a result of this it

*A full summary of this paper is on file at the Bureau.

is now possible for every locality to cultivate only those varieties that are adapted to it—the State Variety Testing Service is testing over 2,000 Soviet and foreign varieties of 125 different crops at 400 different stations.

Breeding methods are being fundamentally changed so as to form a complex system involving the co-operation of physiologists, phytopathologists, entomologists, chemists and technologists. The more important achievements in the form of improved new varieties are reviewed. Special mention is made of the use of wild fruit trees in hybridization by Michurin, of the hybrids of wheat by rye of Meister and others, the production by interspecific crossing of wheats of the *vulgare* type having the hard *durum* grain, of perennial wheats from crosses with *Agropyrum*, of fertile amphidiploids between a number of species giving sterile hybrids and of sugar beet x mangold hybrids with increased yield.

Special reference is also made to the discovery of new species of wheat and potatoes and the valuable practical results that are already beginning to accrue therefrom ; also to the valuable results obtained from artificial curtailment of the length of day in many southern forms of both herbaceous plants and trees.

Special new methods, suitable for use by breeders, have been elaborated for determining the cold and drought resistance and other physiological properties of the plant, extensive tests have been carried out with success on vernalization, special attention has been devoted to quality in nearly all crops, and the areas of possible cultivation of a great number of crops, notably cotton, have been extended by the production of improved forms.

Collections have been made of the cultivated plants of the whole world, the wild fruit trees having proved to be specially interesting and important, the centre of origin of most European fruit trees having been shewn to be in Transcaucasia and Central Asia, including parts of Persia and Turkey. A thorough study of these areas is being executed. Great numbers of new plants have also been brought into cultivation, including the valuable new rubber plant tau-saghiz, which yields a rubber of the first quality.

The application of cytogenetics has led to the production of polyploid forms of certain small bush fruits with increased berry size. Similarly Pangalo's studies on the cucurbits have made known the extent and the interrelationships of this large group for the first time, by classifying the whole world collection and separating out the most valuable types, and by crossing with species themselves not distinguished by high sugar content twofold increases in the sugar content have resulted.

CEREALS 633.1

67. PRUTSKOVA, M. G. 633.1:575(47)
(Breeding grain crops.)
Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 93–103.

The most notable achievement of the Soviet grain breeders is the distribution of 59 improved varieties of the main grain crops, winter and spring wheat, barley, oats and rye, suitable for cultivation in all the main regions of the Soviet Union. These 59 represent the best varieties chosen in variety tests involving 500-600 varieties, and some of them have been the means of extending the cultivation of the crop in question into new areas, for instance wheat growing has been pushed farther north by the production of the ultra-early spring wheat Novinka, also possessed of excellent grain qualities, and of various new hardy winter wheats, including rye-wheat hybrid 46/131.

The same is true in the case of barley and oats. One of the new early oats is also highly resistant to drought and to rust.

Cultivation in the arid zones has been made possible by the creation of new drought-resistant varieties of wheat and barley at the same time distinguished by improved quality and greater earliness.

Still further improvement in these varieties is desired nevertheless in respect of yield, and in some cases also quality or cold-resistance, and in nearly every case in respect of disease resistance. Various hybrids and selections distinguished by improved disease resistance are quoted, special interest being attached to hybrids of *Avena sativa* x *A. byzantina*, which in 1933 exceeded the standard in yield by four times and are much more resistant to leaf rust ; certain American and Canadian wheat hybrids are also very promising.

For purposes of mechanized harvesting, great importance is directed to non-shedding and non-lodging strains and mention is made of a number of varieties favourable in this respect, and of others that are promising in all respects but this. For instance, a new rye produced at Detskoje Selo by crossing the local rye with Rümker is free from both lodging and shedding whilst exceeding the standard variety Vyatka considerably in yield.
A table is given in which the origin of all the most promising new varieties is shewn, *i.e.* the material from which they were produced and the methods used, whether selection or hybridization, etc. From this it is clear that the local varieties have contributed most to the formation of the new improved material, since they are the ones preeminently possessed of the desired characters, such as drought and cold resistance, earliness, yield, etc. Many of these local varieties were introduced years ago from abroad and often represented partly impure populations of some successful cultivated variety, since which time they have been subjected to a process of natural selection for tolerance of the unfavourable conditions of the particular region in which they are grown. An emphatic plea is made for the preservation and further study of these local varieties and for an extension of the work of hybridizing them with varieties from other countries, especially those countries known to be characterized by varieties possessed of certain special characters, such as earliness in the wheats of the near East, etc. etc.
The practical possibilities of distant hybridization are also emphasized and reference is made to the production of hybrids possessed of a non-shedding habit, drought-resistance, good milling and baking quality and satisfactory yield from crosses of hard and soft wheats at Saratov, valuable rust-resistant oats from *Avena sativa* x *A. byzantina* and disease resistant wheats from crosses of *T. durum* with *T. dicoccum*; and finally to the new genus *Secalotriticum* produced from crosses of wheat and rye, together with a number of other useful hybrids from the same cross, one of which is already being grown on quite a large scale. In 1930 successful crosses were made of spring wheat with *Agropyrum intermedium* and more recently with *A. elongatum*, from which it is hoped to obtain perennial wheats and so present an entirely new solution to the problems of drought and cold resistance.
A plea is also made for an attempt to accelerate the speed of breeding work by application of vernalization and other measures and to reduce the period required to produce a new variety, if possible, to 5 years.

68. Rosenstiel, K. von 633.1:578.088.2:581.46

Einzelährendrescher. (**A single ear thresher.**)
Züchter 1934: **6**: 119–20.

A thresher, of interest to the plant breeder, which threshes individual ears is figured and described. Though not suitable for all kinds of cereals the machine has been used at the Kaiser Wilhelm's Institute in Müncheberg for wheat, rye and naked barley.

69. Constantinescu, E. 633.1–2.111–1.521.6

Metode pentru determinarea rezistenței la ger a cerealelor de toamnă. (**Methods for the determination of frost resistance in winter cereals.**)
Viața Agric. 1934: **25**: 144–52.

The best indirect methods for the determination of frost resistance in wheat were electrical conductivity and the estimation of sugars and dry matter by the refractometer. Only the first method was suitable for barley. Of all the methods tested, that of artificial freezing gave the most certain results.
The resistance of some Rumanian varieties is given.
To increase the number and resistance of strains suitable for Rumanian conditions crossing with foreign, especially American, varieties is advocated.

70. ÅKERMAN, Å. 633.11 Fylgia
Ny, tidigt mognande varvetesort för södra och mellersta Sverige. (**Svalöf's Fylgia spring wheat. A new, early ripening spring wheat variety for south and central Sweden.**)
Sverig. Utsädesfören. T. 1934 : **44** : 61–67.

Fylgia spring wheat was obtained from the cross Aurore x Extra-Kolben, made with the object of combining the early ripening, good strength of straw and high specific yield capacity of Aurore with better grain quality and higher resistance to black rust.
Fylgia which ripens about the same time as Diamant has yielded well in comparison with the standard varieties and has shewn a high degree of resistance to black stem rust and a good resistance to yellow rust.
The new variety has a high hectolitre weight and its baking capacity, though better than that of Aurore, is not as good as that of Extra-Kolben II ; it is hoped, however, that it may be improved by selection.
Fylgia wheat has a relatively high crude protein content and its straw is very stiff.

71. 633.11 Thatcher
Thatcher wheat.
J. Amer. Soc. Agron. 1934 : **26** : p. 452.

Thatcher wheat is a new hard red spring wheat, named by the Minnesota Agricultural Station, and so promising in field, milling and baking tests that it has replaced Marquillo on the list of varieties recommended by the station.

72. JAKUBZINER, M. 633.11 *T. Vavilovii*
(**Discovery of a new species of wheat in the Armenian foothills.**)
Priroda (Nature) 1933 : No. 11 : 72–73.

Quite recently in East Anatolia a further new winter wheat with 42 chromosomes, has been found. Its main characteristic feature is the branched ears but it differs in a number of other features also from *Triticum vulgare* and has been established as an independent species *T. Vavilovii*.
It displays more resemblance to *T. Spelta* from which it differs however, in having a tough rachis and in a number of other respects. The branching occurs in nearly all spikelets from top to bottom.
It is valuable agronomically on account of its earliness, entire freedom from shedding, strong straw and vitreous grain high in protein. It is also drought-resistant but suffers somewhat from rust.

73. 633.11(49.9)
SCHREIBER, L. 633.11:581.49
(**Wheats of the islands of the Mediterranean.**)
Bull. Appl. Bot. Leningrad 1934 : Ser. 5 (2) : 41–240.

Observations were made over a period of three years in 8 stations in the U.S.S.R. on the wheats from all the main islands of the Mediterranean, with the exception of the Balearic Islands and Corsica. The author makes use of Flaksberger's modification of Koernicke's system, though clearly stating that density is not regarded by him as a sub-varietal character.
The islands are taken in turn, starting from the most westerly, Sicily ; details are given of the area under wheat cultivation, the average yields obtained, the methods of cultivation employed, the time of sowing and the climatic features of the island as well as the characteristics of the wheats themselves. The specific and varietal composition are given, followed by detailed descriptions, with illustrations of the varieties and forms occurring, with indications of their local names and synonyms. Reference is also made to the main sources of literature dealing with the wheats of each island. A list is given of the local names in Sicily and Sardinia shewing the botanical form to which each belongs, the existing synonyms and the area of distribution. Sharp differences are observed between the wheats of one island and the other. For instance Corsica has a predominance of soft wheats whilst the neighbouring island Sardinia contains

mainly *T. durum* ; the wheats of Malta are entirely different from those of Sicily and even contain a number of endemic forms ; the most interesting of these are the waxless forms of *T. durum*, which are morphologically quite distinct from the waxless forms of Syria. Cyprus contains a number of endemic forms and the remainder more closely resemble the wheats of North East Africa than those of the neighbouring countries. On the other hand certain forms possessed of striking characters of the ear, such as *T. polonicum*, the branched *T. turgidum* and *T. durum* var. *melanopus longiseminatum*, have attained a wide distribution, though in small quantities, by direct introduction from one country to another.

Of all these wheats the *durum* wheats of Sicily are the most European in type. Many of them shew clear relationships with the *durum* wheats of North Africa, though the numerous changes they have undergone shew that a long time must have elapsed since their introduction. The soft wheats have entered from the north and west, apparently largely from the Balearic Islands and the *turgidum* wheats have evidently been introduced by amateurs.

Sardinia is the seat of a very ancient agriculture and many ancient forms of *durum* wheat have been preserved, mainly related to the North African and Spanish forms rather than the Italian, which is particularly evident in the gigantism and coarseness of the whole plant. It is probable that wheats of similar antiquity could also be found in Corsica.

The islands of the Greek archipelago contain *durum* forms related to those of Cyprus and others related to the Kubanka of southern U.S.S.R.

Rhodes contains certain endemic forms and Sicily and Crete are characterized by the possession of a number of forms intermediate in type between *T. durum* and *T. turgidum*, which also appear in Sardinia and other Mediterranean islands. They are classed as *T. durum* but contain characters of *T. turgidum* in respect of form of ear, glume, tooth and grain. Several varieties of these wheats are described. Intermediate forms obviously arising from interspecific hybridization occur in Rhodes. In the south west of Cyprus a whole group of liguleless forms of *T. durum* has developed, a character not found in any other country in the world. A table shewing the frequency of the different varieties of *T. durum eligulatum* is given, with descriptions of their vegetative characters and a key for their diagnosis. Various " semi-liguleless " forms also appear.

The Cyprus wheats also shew relationship with those of Egypt and of Asia Minor.

On account of the large, heavy, vitreous grain of these wheats, together with a number of other valuable agronomic characters, some of them are useful for breeding. The wheats of Sicily are highly resistant to spring drought and to lodging. Those of Cyprus are, together with those of Abyssinia, the earliest *durum* wheats in the world and in earliness of earing these Cyprus wheats are inferior only to certain forms of Palestine and Syria. The Sicilian wheats represent the other extreme of late maturity. Certain varieties from Sardinia are very resistant to the various rusts and others have extremely thick and strong straw.

The characteristic shapes of the ears of the various types are given by Ohlmer's stachymetric method.

There are indications that in these wheats a narrow keel and glume tooth are correlated with a rounded form of grain and ease of threshing.

74. 633.11(56.6)
633.11 *T. dicoccoides*
633.11 *T. aegilopoides*
633.11 *T. Thaoudar*

TUMANYAN, M.

(The botanical diversity of the wild wheats in Armenia.)

Bull. Appl. Bot. Leningrad 1934 : Ser. 5 (2) : 241–68.

The discovery in Armenia in 1929 of the wild wheats, hitherto only known in Palestine and Syria, disclosed a new centre of origin of wheat species, as demonstrated by the large number of varieties discovered, many of them endemic and most of them new. For instance 10 botanical varieties of *T. dicoccum* have been found, of which 8 are new ; 30 varieties of *T. aegilopoides*, 21 new ; and 23 of *T. Thaoudar*, 16 new.

They occur only in the mountains, the greatest number at 1,250–1,350 m. in the case of *T. dicoccoides* and 1,300–1,500 m. for *T. aegilopoides*. They are absent in the northern part of Armenia and a list is given of the places where they have been found. The variety of forms

in the neighbourhood of Kurbagal is quite remarkable, especially in the case of the two einkorn species.
The Armenian forms of *T. dicoccoides* are distinct from the Palestine forms in a whole series of characters and are regarded as a very ancient group which have long evolved independently. A table is given shewing the points of distinction. They have the same number of chromosomes, 2n = 28.
New types appear in the form of einkorn with smoky grey ears, short awns, green grains, short ears with small glumes and grains, black glume margin on a white or red ground ; also forms with smooth glumes, hitherto known only in cultivated einkorn (*T. monococcum*), in Armenia are predominant. One form was in every respect similar to *T. aegilopoides* except in the possession of elongated grains as in *T. dicoccoides* ; it is being examined cytologically.
A key to the varieties found is given for each of the three species.

75. GAINES, E. F. 633.11:575.12(79.7)
The value of the hybrid wheats produced by the state college of Washington.
Northwest Science. 1933 : **7** : 8–12.
Wheat breeding on Mendelian lines at the State College of Washington was begun by Spillman during the first years of the present century with the object of producing a winter hardy, stiff strawed, non-shattering and high yielding wheat.
The breeding work has been continued with the additional aim of smut resistance and the five hybrids Albit, Triplet, Hybrid 128, Hybrid 123 and Ridit have now replaced the old standard wheats Jones Fife, Fortyfold, Red Russian and Little Club.
Statistics are given to shew the increased production and other advantages of the hybrids.

76. BERG, K. H. VON 633.11:575.127.2:576.312
Cytologische Untersuchungen an *Triticum turgidovillosum* und seinen Eltern. (Weitere Studien am fertilen konstanten Artbastard *Triticum turgidovillosum* und seinen Verwandten.) II. Teil. [**Cytological investigations on *T. turgidovillosum* and its parents. (Further studies on the fertile constant species hybrid *T. turgidovillosum* and its related forms.) Part II.**]
Z. indukt. Abstamm. –u. VererbLehre. 1934 : **67** : 342–73.
The present paper represents the preliminary conclusive results of a comparative study of the karyological structure of *T. turgidovillosum* and its parents. An examination of the somatic chromosomes of *T. villosum* (14n) and *T. turgidum* (28n) shewed that the resemblance of the individual chromosomes was such that they could not be identified.
The hybrid has 42n chromosomes and the regularity at meiosis suggests a doubling of the parental genoms and as the morphology of these offered no proof of the theory, comparative measurements were made of the individual chromosomes.
Besides a very striking resemblance between the measurements of the chromosomes of *T. villosum* and those given by Kagawa for *T. monococcum* there was good reason to suppose that the hybrid possessed the genoms of its parent, though altered to some extent by the new environment. Comparative studies of meiosis lend some support to this supposition. Measurements of cell size in the root and pollen mother cells of the parents and hybrid shewed a remarkable independence.
By using a modification of the formula of Wettstein for volume relations in polyploids $V_n = nV_ok^n$ the material provided the following results from the pollen mother cells, K = 1·08 and $V_v:V_o = 1:0{\cdot}43$ and shews that the forms in question can be considered as a polyploid series, all changes in size being understood as the effect of the multiplication of the genoms, *i.e.* polyploidy.

77. KATTERMANN, G. 633.11:575.127.5:633.14:576.354.4
Die cytologischen Verhältnisse einiger Weizenroggenbastarde und ihrer Nachkommenschaft (" F_2 "). [**The cytological relations of some wheat-rye hybrids and their progeny (" F_2 ")**.]
Züchter 1934 : **6** : 97–107.

In the F_1 from the cross between a " blue grained " wheat with winter rye previously described (see " Plant Breeding Abstracts," Vol. IV, Abst. 955) at the first reduction division sometimes five and once even six bivalents were observed and 1–2 trivalents. One ring per cell was seen fairly frequently and twice two rings in a cell.

About 50 plants of the " F_2," that is the F_1 backcrossed to wheat, were examined in the hope of determining the chromosome number of those egg cells of the first generation that are capable of functioning.

The 2n chromosome numbers varied from 38–52, hence the F_1 egg cells had between 17–31 and the frequency of unreduced or almost unreduced female gametes was so high that this is the most likely cause of the chromosome numbers above 49.

The course of the reduction division is described. An examination of the variations in chromosome combinations in the pollen mother cells shewed the presence of combinations of 3–6 chromosomes.

Fragmentation occurred in some plants.

The " F_2" hybrids shewed frequently cytomixis in the prophase and the results of this in the later stages. There was a clear relationship between chromosome number and fertility : fragmentation and low chromosome number reduced the fertility, plants with 2n = 49 had on the average the best fertility while those with 50 chromosomes were surprisingly good ; self-fertility shewed about the same relations.

78. *TZITZIN, N. V. 633.11:575.127.5:633.289
(**The *Triticum* x *Agropyrum* hybrids.**)
Lenin Acad. Agric. Sci., Siberian Inst. Grain Cult., Omsk 1933 : pp. 101.

Couch grass is one of the least exacting plants in the whole of the wild flora and one of the most widely adaptable. The present investigations, which involved a number of different species of *Agropyrum*, have shewn that four of these will cross with wheat, *viz. A. glaucum* (Desf.), *A. trichophorum* (Link.), *A. elongatum* (Host.), *A. junceum* (L.). They are regarded therefore as more rightly belonging to the species *Triticum* than *Agropyrum*. From these species plants have been isolated which give quite high yields of grain, *e.g.* up to 62 grains per ear and 3,658 grains per plant, and these high-yielding plants gave partially self-fertile hybrids with wheat.

The work was done mainly with *A. glaucum* (2n = 42) ; both this species and *A. elongatum* (2n = 70) crossed with equal ease with all species of wheat regardless of chromosome number. From 3,021 flowers pollinated in 1931, 1,823 grains, *i.e.* 60·3 per cent, were procured. There was some variation in the success obtained with different strains of the *Agropyrum* species and *Triticum durum* tended to give higher percentage successes than *T. vulgare*. The successes in the reciprocal crosses where wheat served as pollen parent were much reduced, though successes of up to 31 per cent were obtained in odd cases. In the case of *A. elongatum* (2n = 70) this is contrary to the accepted idea that success is greater when the higher chromosome parent serves as female.

Little success (2 per cent) was obtained in crossing these species of *Agropyrum* with those that do not cross with wheat.

The hybrid grain was mainly intermediate between the two parental types. The largest grains were obtained from the combinations *T. durum* x *A. glaucum* and *T. vulgare* x *A. elongatum*. The germinating power was perfectly normal in the hybrids with *T. vulgare*, somewhat less in the *T. durum* hybrids. Thus the higher percentage success is associated with a lower grain weight and germination capacity and vice versa.

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* **An abridged translation of this paper is on file at the Bureau.**

The hybrid grains giving three seedling roots like *Agropyrum*, as opposed to the five in wheat, generally give rise to perennial plants. Most of the F_1 plants were of this type and were characterized by luxuriant tillering, giving 100 ears and more in the first year, and a remarkable capacity for vegetative segregation. The pollen fertility of the F_1 plants varied, in some cases reaching as much as 50 per cent. A success of only 5·7 per cent was obtained in back-crosses with wheat, 298 grains being obtained from 5,241 flowers. A greater percentage of back-crosses was obtained by sowing the hybrids side-by-side with wheat in a cage.

The F_1 hybrids of *A. elongatum* are characterized by a very vigorous root system, often more than the *Agropyrum* parent, and by almost entire immunity to rust, smut, mildew and aphis. The hybrids of *A. glaucum* are, like the parent, much more susceptible. The hybrids of *A. glaucum* proved equal to the most drought-resistant spring wheat known, *milturum* 0321, whose drought-resistance they exceeded under conditions of protracted desiccation. Extreme cold resistance was observed in the hybrids with winter wheat and to a certain extent also in hybrids of *A. elongatum* with spring wheat.

Cytological examination of the F_1 hybrids shewed the expected somatic numbers, 42 in the hybrids of *T. vulgare* x *A. glaucum*, 56 in *T. vulgare* x *A. elongatum*, 35 in *T. durum* x *A. glaucum*, and 49 in *T. durum* x *A. elongatum*.

The F_2 shewed wide segregation for all characters and many entirely new forms and characters appeared, including certain types resembling *Aegilops*. This leads to the suggestion that *Agropyrum* has contributed to the origin of the genus *Aegilops*.

The F_2 plants displayed somewhat more resemblance to wheat than to *Agropyrum* and gave up to 50 per cent success when crossed with wheat. Most of the distinguishing characters between the two species segregated independently. Out of 190 plants in the F_2 generation 139 are perennials (*i.e.* 73·2 per cent) ; 44 were sterile (23·1 per cent) and the remaining 109 (76·6 per cent) fertile. The fertility in the F_3 was higher but the proportion of perennial plants was considerably less, falling to 1·0 per cent in F_4. However some of the other families not studied in detail shewed indications of having much higher proportions of perennials. The ripening of the ear in the first three generations was from above downwards, as opposed to the common method for cultivated cereals.

The *Agropyrum* species which do not cross with wheat were tried with rye but the success was low ; 33 hybrid plants have been obtained and are under examination.

The author is confident that his hybrids will lead to the production of wheats superior in drought and cold resistance to all known forms, thus making possible the cultivation of winter wheat in all wheat-growing regions of the Soviet Union and considerable extension of wheat cultivation towards the north. The character of resistance to salty soil is sought for in the hybrids of *A. elongatum*, which is preeminent in this respect and seems to transmit this capacity to the first generation.

Some of the hybrids are distinguished by very luxuriant vegetative development and are promising as fodder plants. Finally it is thought possible to produce a perennial wheat and so bring about a still greater revolution in Soviet agriculture. In the annual forms hybrids giving up to 500 grains per plant, and at the same time non-shedding, non-lodging, disease-resistant and possessed of vigorous and abundant root system and excellent physical qualities of the grain are now available and constant forms will be isolated from them in 1934. Considerable work is still necessary with the perennial forms but it is expected that lines will be ready for testing by 1937.

79. HONECKER, L. 633.11:575.2:551.56
Untersuchungen über den Einfluss der Jahreswitterung auf den Entwicklungs rhythmus und die Struktur des Ertrages bei Sorten und Neuzüchtungen von Sommerweizen. Ein Beitrag zur Ökologie des Sommerweizens. (**Investigations on the influence of the weather during the year on the developmental rhythm and the constituents of the yield in varieties and new strains of spring wheat. A contribution on the ecology of spring wheat.**)
Landw. Jb. 1934 : **79** : 371–92.

A careful analysis of the effect of weather on the vegetative development and therefore on the yield of a number of varieties of spring wheat over a two year period shewed that there were definite varietal differences in reaction to the weather and that the breeding of strains adapted to the climate of a locality was a practical proposition.

80. Voss, J. 633.11:581.142:575
Keimungsphysiologische Untersuchungen an Weizensorten. (**Researches on the physiology of germination in wheat varieties.**)
Angew. Bot. 1934: **16**: 137–86.

These researches represent part of a scheme for the identification of wheat varieties using both morphological and physiological characters. Besides germination the susceptibility of the grain to a one per cent solution of phenol was tested.
It was found that the species of *Triticum* and the varieties of *T. vulgare* shewed heritable differences in their speed of germination. Varieties of *T. vulgare* also shewed heritable differences in the duration of the resting period before germination.
No relation was found between speed of germination and grain colour or between the length of the resting period and grain colour or time of ripening.
The phenol test provides a useful method for the separation of wheat varieties in the laboratory. The physiological tests confirmed the results of the morphological identification.

81. Peltier, G. L. and Kiesselbach, T. A. 633.11:581.143.26.03
Inducing early fruiting in winter wheat by seed activation.
J. Amer. Soc. Agron. 1934: **26**: 503–06.

Germinated seed of the two winter wheat varieties Turkey and Early Blackhull was kept at a temperature of 35°F for 60, 30, 15, and 7 days just before planting, and each of these lots was divided into three parts, one of which received no further treatment; a second was frozen at 28°F for three hours and a third frozen at –4°F for 1 hour. All the seed was then planted on March 30 with control seed of the two winter wheats and germinated seed of Ceres and spring wheat.
All the seed kept when germinated at 35°F for 60–30 days whatever its subsequent treatment headed at about the same time as the spring wheat. No heading was observed in any of the other plots.
The experiments were repeated the following year except that the freezing was done before storage, but the the results were not affected.

82. Schribaux 633.11:581.143.26.03
Printanisation des blés et constante héliothermique. (**The vernalization of wheat and the heliothermic constant.**)
C.R. Acad. Agric. Fr. 1934: **20**: 354–56.

A heliothermic constant P= the sum of the average daily temperatures from the date of sowing to the earing date x the length of the day for the same period, has been found to be characteristic of a given variety of wheat and is not altered when the seed is vernalized.

83. Florell, V. H. 633.11:581.162.32:578.08
A method of making wheat crosses.
J. Hered. 1934: **25**: 157–61.

Full particulars are given of the equipment required, the method of selection of a suitable spike on the ♀ parent plants at the proper stage of development, and the processes of emasculation and pollination. The best time to transfer pollen to emasculated heads is when blooming occurs naturally in the ♂ parent.
The pollen may be obtained by stroking with the fingers from base to tip a spike about to blossom and thus causing the ripe anthers to be exserted after 2 or 3 minutes. The pollen can be shaken into a container when the anthers are partially exserted. This procedure which can be used for growing plants and freshly cut ears reveals the available pollen supply without the necessity of opening individual flowers.

During several seasons good results were generally obtained by applying pollen with a spatula at any time up to 6 or 8 days after emasculation.
The percentage of seed set was appreciably higher when the above method was used than when the older method of selecting ripe anthers and placing them in individual florets was employed. Other useful hints and two good illustrations add to the value of the paper.

84. 633.11:581.46
TUMANYAN, M. 633.1:581.46
(Branched soft wheat.)
Bull. Appl. Bot. Leningrad 1934 : Ser. 5 (2) : 269–82.
Reference is made to forms with branched ears known in *T. turgidum* and *T. dicoccum* and in rye. So far no such forms of *T. vulgare* or *T. compactum* have been found, even in the centre of diversity of these species. However in 1929 in a sample of wheat from eastern Anatolia true soft wheats were found with branched ears, which peculiarity was transmitted to the progeny. The group is endemic to the Armenian plateau and is characterized by a number of other peculiarities such as the presence of thorn-like spicules on the glumes, a character also possessed by many of the ryes of this region. The new wheats constitute an ancient and distinct group. A new sub-species is established for these branched wheats, *Triticum vulgare compositum*, and two varieties of it are described.
Agronomically these wheats are of interest on account of their earliness, drought resistance, high percentage of protein in the grain and stiff straw.

85. JAKUBZINER, M. 633.11–1.524.4
(Discovery of wild wheat in the U.S.S.R.)
Priroda (Nature) 1933 : Nos. 8–9 : 98–102.
A brief general survey is given of the wild wheats found in Transcaucasia and the features which distinguish them from the Palestine group. The fact that in addition to *Triticum dicoccoides* and *T. aegilopoides* there have been found three new species of wheat in Transcaucasia, viz. *T. persicum*, *T. Timopheevi*, *T. macha*, indicates that this is an independent centre of origin of wheat species.

86. 633.11–2.111–1.521.6:575
FUCHS, W. H. 633.11–2.111–1.521.6:578.081
Beiträge zur Züchtung kältefester Winterweizen. **(On the breeding of cold resistant winter wheats.)**
Z. Züchtung 1934 : A **19** : 309–23.
The low temperature house at the Institut für Pflanzenbau, Halle, and its uses in selection work and in testing winter wheat on a large scale for hardiness under conditions similar to those found in the field are described ; and various points of technique are also discussed.
The process has been used in the artificial selection of 69 populations and in testing 322 strains for breeding purposes. Strain testing in the low temperature house shewed satisfactory agreement with the field tests.
The selective breeding results are not given in detail but attention is drawn to the fact that, in these experiments too, transgressive inheritance of cold resistance occurred in some cases both in a positive and a negative direction.
Simultaneous tests of the breeding strains by various indirect methods of testing for cold resistance (*e.g.* refractometric, saccharimetric, etc.) again demonstrated the practical utility of these methods.

87. RUDORF, W. and ROSENSTIEL, K. VON 633.11–2.451.2–1.521.6:575.11
Untersuchungen über die Widerstandsfähigkeit bei Weizensorten gegen Weizenflugbrand, *Ustilago tritici*, und über ihre Vererbung in Kreuzungen. **(Investigations on the resistance of varieties of wheat to loose smut, *U. tritici* and the inheritance of this resistance in crosses.)**
Z. Züchtung 1934 : A **19** : 324–32.
The results of artificial infection of 86 varieties of wheat with *U. tritici* were estimated on the basis of the behaviour of entire plants (not the individual ears). Among the immune varieties

were 38 M.A., Chines 466, Saumur 61 and other better known sorts such as Marquis, Huzzar, etc. In the very resistant group were found Pagador, Apulia, Staror, Alto de Sierra, Hard Federation, Heines Kolben, etc.
Infection of various susceptible and resistant varieties with smut samples from different districts failed to reveal the existence of several races of smut—a fact which points to the wheats tested being resistant to several races and thus constituting promising material for breeding immune sorts.
The infection ratios in an F_3 from the cross San Martin x 38 M.A. suggested that the resistance of 38 M.A. probably depends on three recessive factors.

88. 633.11–2.452:576.16
RUDORF, W. and JOB, M. 633.11–2.452–1.521.6:575
Untersuchungen bezüglich der Spezialisierung von *Puccinia graminis tritici*, *Puccinia triticina* und *Puccinia glumarum tritici*, sowie über Resistenz und ihre Vererbung in verschiedenen Kreuzungen. (**Investigations on specialization in *P. graminis tritici*, *P. triticina* and *P. glumarum tritici* and on resistance and its inheritance in various crosses.**)
Z. Züchtung 1934 : A **19** : 333–65.
Under conditions in the Argentine various forms of *P. graminis tritici* were found to occur in separate years during the tests ; but none of the forms discovered was identical with any of the 128 described by Stakman and his school.
The resistance of various well-known wheats (*e.g.* Kanred, Kota, Hope, etc.) agreed with their behaviour as recorded in North America.
In populations of three collections of *P. triticina* four different groups of forms were discovered and again the races changed from year to year. The wheat varieties Riccio, Ardito, Fultz and Chargorod proved resistant ; whilst Carina, Brevit, Webster, Mediterranean, Democrat and Kawvale varied in response according to the race of *P. triticina* occurring in the various years. The latter group of wheats appear however to be resistant to several forms.
A number of varieties of wheat proved resistant to *P. glumarum tritici*, some in the seedling stage as well as in the field (*e.g.* Chinese 166 and 165, Roter Sommerkolben) whilst Mentana and Riccio were susceptible in the seedling stage but very resistant in the field. The occurrence of biotypes other than the European forms is recorded, though owing to technical difficulties no conclusions could be reached as to physiological specialization in *P. graminis tritici* in the Argentine.
Combined resistance to several species of rust was found in several varieties of wheat.
In general the inheritance of resistance was Mendelian in type but, as might be expected, no definite rule as regards dominance or recessivity of the character could be formulated. A number of promising new crosses and also the possibilities in species and genus hybridization are briefly mentioned.
There is an extensive bibliography.

89. CONSTANTIN, J. 633.11–2.452–1.521.6
Variétés de blé resistantes à la rouille. (**Varieties of wheat resistant to rust.**)
C.R. Acad. Sci. Paris 1934 : **198** : 130–33.
In the author's opinion the failure to produce wheat varieties resistant to rust has been due to a lack of appreciation of the problem. Arguing from the analogy of the production in Java of the sereh resistant cane P.O.J. 2878 the author suggests that similar results may be obtained by using resistant wheats from mountainous districts as parents in crossing experiments.

90. KŘTINSKÝ, K. 633.11:664.641.016:581.081
Die Prüfung der Eigenschaften des Klebers. (**Testing the properties of gluten.**)
Mühlenlaborat. Lpz., 1933 : **3** : 97–104.
The scale used for indicating the properties (elasticity, extensibility and strength) of gluten at Prague and the methods used for estimating these properties are described in detail.

Apparatus has been constructed to replace the hand method of estimating these properties: the elastoscope for elasticity and the fortiscope for extensibility and strength, which shew up differences between flours which would be missed by the hand method. The results obtained from these scales agree with those obtained from the farinograph. Flours can be arranged in five groups according to these scales, which grouping agrees with baking tests. The plotted relationships between character of gluten respectively, baking quality and water absorption, shew that the strength of the gluten exerts the greatest effect on baking quality. If the strength of the the gluten according to this scale is known, the baking quality can be read off directly from the graph.

91. CRÉPIN, C. 633.11:664.641.016(44)
Le mauvais pain. (**Poor bread.**)
C.R. Acad. Agric. Fr. 1934: **20**: 568–72.
Contains a further note on the merits of P.–L.–M. 1 mentioned in the paper by Schribaux. (See Abst. 93 below.)

92. ALSBERG, C. L. and GRIFFING, E. P. 633.11:664.641.016:575
Environment, heredity, and wheat quality.
Food Res. Inst. Stanford Univ. Cal. 1934: **10**: 229–49.
The main factors concerning quality in wheat are discussed and the results of the principal investigations on the major factors, climate, soil and variety are reviewed.
It is suggested that the time and amount of desiccation at the flowering period is an important factor in the quality and quantity of gluten in the developing grains.
The present tendency is for each country to attempt to produce its own high quality wheats and there is no doubt that breeding may accomplish this to a great extent though it is doubtful whether the wheat grown in humid countries will ever equal that of semi-arid districts.

93. SCHRIBAUX 633.11:664.641.016:575(44)
L'amélioration de la valeur boulangère de nos blés. (**The improvement of the baking quality of our wheats.**)
C.R. Acad. Agric. Fr. 1934: **20**: 565–67.
P.–L.–M. 1. isolated from a local sort Mouton from the Dijon district is resistant to cold and rusts, is early and has a high baking quality. From 20 to 25 per cent used with a mixture of the flour of local wheat makes a most satisfactory loaf without the need of the addition of imported wheat and a local baker has been wholly converted to its use.

94. 633.11*Aegilops*:575.127.5:633.14:581.4
OEHLER, E. 633.11*Aegilops*:575.127.5:633.14:581.162.5
Untersuchungen über Ansatzverhältnisse, Morphologie und Fertilität bei *Aegilops-Secale*-Bastarden. (**Investigations on the grain setting behaviour, morphology and fertility in *Aegilops-Secale* hybrids.**)
Z. indukt. Abstamm. –u. VererbLehre. 1934: **67**: 317–41.
A large number of crosses were made using *Aegilops* always as the female parent. Eighteen of the 22 species of *Aegilops* and various races of wild rye from Asia Minor, and of German winter and spring rye were used. The total average setting was 8·03 per cent but there was a great deal of variation. On the whole those species of *Aegilops* which cross readily with wheat crossed readily with rye and *vice versa*. In the author's opinion the variation in grain setting is due to the different times of flowering of the parent species.
The success in crossing is quite independent of the degree of relationship between the individual species of *Aegilops* and rye and of the chromosome number and the number and specificity of the genoms of the parent species. The 14 and 21 chromosome species of *Aegilops* cross well with the 7 chromosome rye while almost all 7 chromosome species of *Aegilops* shew a poor set of grain. The grain from the easily successful crosses was for the most part plump and normally formed, that from those crosses which were only made with difficulty was as a rule very shrunken.

The general morphology of the F_1 hybrids is described in detail and then that of the following eight individual hybrids of *Ae. cylindrica*, *variabilis*, *Kotschyi*, *triuncialis*, *columnaris*, *biuncialis*, *triaristata* and *ovata* with *Secale*.
Except for the occurrence of pubescence of the culm below the ear only *Aegilops* characters were dominant in the hybrids. Like *Aegilops*-rye or wheat-rye hybrids, the F_1 hybrids flowered with closed anthers. Back-crosses with *Aegilops* or rye were always unsuccessful and the plants growing free remained nearly completely sterile. The two grains obtained failed to develop.

BUCKWHEAT 633.12

95. Schoch-Bodmer, H. 633.12:581.466
Zum Heterostylieproblem : Griffelbeschaffenheit und Pollenschlauchwachstum bei *Fagopyrum esculentum*. (**On the problem of heterostyly : stylar properties and pollen tube growth in *Fagopyrum esculentum*.**)
Planta (Berl.) 1934 : **22** : 149–52.

Experiments on the nature of the difference between the forms of style and pollen which exhibit the inhibition of pollen tube growth within the stigma and style.
By a series of pollinations of foreign species it was shewn that the conditions for pollen tube growth were different in long and in short *Fagopyrum* styles, whereas both pollen forms under certain conditions germinated approximately equally well.
An investigation was then made into (a) why the long style pollen produces longer tubes in the long style than in the short one and the cause of the sudden cessation of growth which occurs in the lowest third of the long styles ; and, (b) why the tubes of the short style pollen are held up already in the transition from stigma to style, *i.e.* in the upper third of the pistil. The following theories are offered as possible solutions of these two problems respectively :—
It may be that the long style offers no impediment to the pollen tubes of its own type and that only after certain (still unknown) substances of the pollen have been exhausted (*e.g.* growth substances) does a fairly rapid cessation of growth ensue. Should the micropyle be reached before the particular substances are used up then fertilization may occur.
It is also suggested that since the long pollen tubes of the short style pollen in self-fertilized short styles are no thicker than long style pollen tubes, possibly in the short styles the vascular tissue differs in structure from the long styles—the short styles being more compact (perhaps having smaller intercellular spaces). In self-sterile short styles all pollen grains have large germ pores and form thick tubes which are quite able to pass through the looser stigmatic tissue but not through the firmer tissue of the style. Pollen of the self-fertile short style type would be assumed to have a greater range of variation of germ pore size, and the pollen grains with smaller germ pores have thinner tubes which are as thin as the long style pollen tubes and can therefore pass through the vascular tissue.

OATS 633.13

96. Buchinger, A. 633.13:575.127.2:575.247
Vegetative Spaltung an dem Haferartbastard : *Avena sativa* L. x *Avena strigosa* Schreb. (**Vegetative segregation in the oat species hybrid : *Avena sativa* L. x *Avena strigosa* Schreb.**
Genetica 1934 : **15** : 393–424.

The present paper represents the outcome of three years work to test the assumption of H. L. Werneck that he had found natural hybrids between *A. sativa* and *A. strigosa*. The author first compares in detail the characteristics of the two species. The assumed hybrid seed when grown shewed all the essential characteristics of *A. sativa*, allowing for such variability as would occur from natural crosses between races in the field.
Among plants of *A. sativa* however, an individual was encountered which possessed some culms characteristic of *sativa* and some of *strigosa*. The grain from these was collected and separately grown and the two groups shewed first marked differences in behaviour on germination but later, apart from the time of ripening there was practically no difference in developmental rhythm between the two groups. Both shewed a violet coloration of the first leaf. From the flowering time onwards there was a marked difference between the two groups, the *strigosa* group ripening

earlier than the *sativa*. In other respects such as culm and panicle length which are very different in the two species, no difference could be observed in the two groups. The fully ripe plants shewed an extraordinarily luxuriant growth.
Within each group there was scarcely any variation, each plant almost exactly resembled the other and no further segregation, either vegetative or genetical, was observed. The author discusses the possible reasons for the behaviour of these plants and comes to the conclusion that it is not a case of atavistic mutation but one of vegetative segregation, a result of an assumed previous natural cross between *A. sativa* and *A. strigosa*, not a new phenomenon in cereals.

97. 633.13:581.46:575.11
EMME, H. 633.13:576.16
Vererbung von Anheftungstypen der Blüten und einiger anderer Merkmale beim Hafer. (**Inheritance of attachment types of the flowers and some other characters in oats.**)
Züchter 1934 : **6** : 108–13.

The type of attachment of the oat flower, a morphological complex of characters, is of practical importance as it determines whether the grains are held or not when harvested.
If all the individual species of *Euavena* Griseb. are examined from this point of view, four types of articulation are found and if the species are grouped on this basis the " cultivated " type of attachment of the 42 chromosome oats is markedly different from that of the cultivated 14 and 28 chromosome oats, and in the development of this character within *Euavena* the usual parallelism between the sub-species of the sub-sections *Aristulatae* and *Denticulatae* shewn by very many other characters, is not observable.
The possibility of improving the attachment of the grains in *byzantina* varieties by the substitution of the genes for this character from some *sativa* forms and even the further improvement of *sativa* varieties by crosses with *abyssinica* ssp. is suggested.
A number of hybrid combinations, diploids, triploid, pentaploid and hexaploid were made and the behaviour of the articulation character noted in the progeny.
From the results it is clear that the same type of articulation may occur in quite different genotypes.
Further the type of articulation of the wild oats is dominant in all the diploid and tetraploid hybrids hitherto described while in the hexaploid group this character may behave differently ; for example in *sativa* x *fatua* hybrids the *sativa* type is dominant.
With regard to the question of derivatives of the cultivated types the inheritance of the articulation type is as follows :—(a) in the 14 chromosomes group the *hirtula* characters are dominant to *strigosa* and *brevis* ; (b) in the 28 chromosome group the *barbata* characters are dominant to those of *strigosa* ; (d) the hexaploid group is not uniform ; in the hybrids within *A. fatua* the cultivated type of articulation of the first floret is dominant ; in the F_1 of ssp. *fatua* x ssp. *byzantina* the wild type is dominant though in the F_1 of *sativa* x *Ludoviciana* the *sativa* type dominates.
From this can be suggested the origin of ssp. *strigosa* as a recessive mutant of a *hirtula*-like form : ssp. *barbata* may be derived by autotetraploidy from *hirtula*-like forms.
The derivation of ssp. *abyssinica* is more difficult and the various possibilities for the origin of these and the possible explanation of the behaviour of the character complex in the hexaploid oats are discussed.
Observations on the hybrids have shewn that in the F_1 of pentaploid combinations the awn of the second floret is always lacking, in cases where the 42 chromosome parent is awned then the hybrids are awnless. This suggests a new point of view on the problem of the origin of awnless cultivated forms by hybridization between awned forms. Unfortunately no F_2 was available but from a comparison with very similar cases (*Lathyrus*), etc., it is suggested that one may assume two genes *G.* causing awnlessness of the first floret which is expressed only in the presence of *C*. Assuming a multiplication of these genes in the polyploid forms one may arrive at a possible explanation which however can only be tested in F_2.
The behaviour of a further group of characters, pubescence of the glumes, awning of the first floret, type of tuft, presence of a ligule, pubescence of the grain and structure of the tip of the

outer glume of the first floret in the hybrids is discussed in relation to polyploidy ; and it is concluded that there exists in nature no law of the dominance in hybrids of the characters of the polyploid forms of a higher rank when crossed with forms with a lower chromosome number, although this does as a rule occur for many characters in genera in which there is possibly true autopolyploidy and doubling of the chromosome number after crossing between relatively closely related forms.

98. 633.13–2.451.2–1.521.6:575
NICOLAISEN, W. 633.13–2.451.2:576.16
Die Grundlagen der Immunitätszüchtung gegen *Ustilago avenae* (Pers.) Jens.
[The basis of breeding for immunity to *U. avenae* (Pers.) Jens.]
Z. Züchtung 1934 : A **19** : 1–56.

The results of investigations on resistance of oats to *U. avenae* and the differences in the virulence of loose smuts of various origins and their mutual relations to each other are summarized. Questions of technique and the establishment of a resistance standard are fully dealt with. A resumé of the work hitherto accomplished in breeding for resistance is given.

The problem of the numerous physiological races of loose smut and the possibilities of breeding oat types immune to all races of the fungus is discussed, the two species *Avena sativa* and *A. byzantina*, which cross well together, being specially mentioned as promising material for use in hybridization.

The changes that may occur in pathogeneity are discussed and such changes when due to passage through a particular host form are regarded as a selective action of that variety of oats. The alternation of generations in loose smut of oats, the pathogeneity of strains from individual spores and the genetic transmission of pathogeneity in such strains and in strains obtained by crossing different spores, and the various ways in which new biological races of the fungus may arise are all considered in their various aspects.

A bibliography of 212 references closes the paper.

99. REED, G. M. 633.13–2.451.2–1.521.6:575.11
Inheritance of resistance to loose and covered smut in hybrids of Black Mesdag with Hull-less, Silvermine, and Early Champion oats.
Amer. J. Bot. 1934 : **21** : 278–91.

A study of the inheritance of resistance to loose smut, *Ustilago avenae* (Pers.) Jens. and covered smut, *U. levis* (K. & S.) Magn., in hybrids of Black Mesdag with Hull-less, Silvermine and Early Champion oats. Black Mesdag has shewn complete resistance to these two races of the oat smuts and also resistance to nearly all races of both loose and covered smut ; though it has proved susceptible to a newly discovered race of covered smut.

The F_2 generations of the three sets of hybrids Hull-less x Black Mesdag, Silvermine x Black Mesdag and Early Champion x Black Mesdag indicated that resistance is dominant and segregation occurs in a 3 : 1 ratio. The F_3 results agreed quite well with the data for the second generation. Nearly all the F_4 progenies were descendants of resistant F_3 families and were nearly all pure resistant types. In all the hybrids many progenies could be found in the F_4 generation that were as resistant as the original Black Mesdag parent.

The similar behaviour shewn by a large number of F_3 progenies in both the loose and covered smut reaction suggest that the same factor or closely linked factors are responsible for the resistance and susceptibility of these hybrids. (Cf. also " Plant Breeding Abstracts," Vol. II, Absts. 425, 611, 612, Vol. III, Abst. 399.)

100. STANTON, T. R., COFFMAN, F. A. and TAPKE, V. F. 633.13–2.451.2–1.521.6:575.11
Field studies on resistance of hybrid selections of oats to covered and loose smuts.
Tech. Bull. U.S. Dept. Agric. 1934 : No. 422 : pp. 10.

A number of hybrids and selections were tested for resistance to covered smut *Ustilago levis* and to loose smut *Ustilago avenae* with the object of combining smut resistance with other desirable qualities.

Two hundred selections from the unnamed oat C.I. No. 357, from which Markton was selected, were grown, and the results indicated the heterogeneity of the parent mass variety and none of the selections surpassed Markton in yield.
A number of hybrid populations were tested from crosses of Markton with Iogren, Silvermine, Idamine, Victory, Swedish Select, Scottish Chief, Ligowa and Early Champion. The data shewed that resistance to the two kinds of smut is inherited independently, contrary to the results of Reed and Stanton with hybrids of Hull-less x Black Mesdag.
Several of the hybrids shewed promising combinations of valuable characters.

MAIZE 633.15

101. 633.15:575(45)
633.15–2.112–1.521.6

Per coprire il fabbisogno nazionale di granoturco. **(To meet the national requirements for maize.)**
Nuova Vita Rur. 1934 : **6** : 116–17.

The cultivation of maize in Italy has been increased by the production of a number of new early varieties through the work of Strampelli. Some of these varieties, whose names are given, are drought resistant and high yielding.

102. 633.15:575.12
635.67:575

MANGELSDORF, P. C.
Growing sweet corn in Texas.
Circ. Tex. Agric. Expt. Sta. 1934 : No. 69 : pp. 27.

Work on the breeding of varieties of sweet corn suitable for the conditions in Texas has resulted in the production of two promising varieties, Honey June and Surcropper Sugar. These varieties were the result of crossing the two Texas varieties of field corn, Mexican June and Surcropper with the sweet corn Country Gentleman, repeatedly back-crossing the hybrids to the field-corn parent, testing the progeny by crossing with a pure sugary for the presence of the essential sugary gene, selfing and finally selecting from the progeny.
The seed was distributed with Stowell's Evergreen, the most grown sweet corn, to a number of growers for comparison and the results of these tests are described.
The resistance to ear-worm, due mainly to the greater protection afforded by the husk, was very pronounced in the new varieties. The paper also contains brief instructions for the cultivation of sweet corn.

103. DAVIS, R. L. 633.15:575.125
Maize crossing values in second-generation lines.
J. Agric. Res. 1934 : **48** : 339–57.

Ears from different districts in Puerto Rico were selected and the superior lines inbred for two generations and then crossed with Yauco-Torre, an unrelated open-pollinated variety.
As a group the hybrids definitely out-yielded the pollen parent used as a standard. In a comparison between the yields of six groups of second generation sib lines crossed with Yauco-Torre and the male parent, five were all either high or low yielding. Of the correlations studied between the line-variety yields and various characters of the inbred parents only the average yield of the first and second inbred generations was positive and significant.
Plants from selected ears, selfed for two generations were crossed with a line assumed to be recessive which had been selfed three times. The yield from these hybrids was not so high as that from the line-variety hybrids. Significant correlations were obtained between the yields of the line-recessive hybrids and plant height and total longitudinal sectional area of the ears per plant of the pistillate parent lines and may be taken as a basis for selection in the second inbred generation. These and the results of other crossings indicate that increased yields may be obtained in hybrids after only two generations of inbreeding.

104. CREIGHTON, H. B. 633.15:576.356.2
Three cases of deficiency in chromosome 9 of *Zea Mays*.
Proc. Nat. Acad. Sci. Wash. 1934: **20**: 111–15.
Investigations to locate the position of the gene yg_2 (yellow green) in chromosome 9 by means of X-ray induced deficiencies produced three deficient plants which were examined cytologically. In one case the distal part of the short arm of the modified chromosome 9, including the terminal knots was lacking, in the other two cases the deletion was of an internal segment of the short arm of the same chromosome. The behaviour of these deficient plants shewed that the locus of the gene yg_2 is very near to the end of the short arm of chromosome 9.
A case of deficient but viable gametes is described.

105. PIACCO, R. 633.15:577.83
Ermafroditismo nel mais. (**Hermaphroditism in maize**).
G. Risicolt. 1934: **24**: 108–16.
A number of cases of hermaphroditism in maize is described and their importance from a theoretical point of view is noted.

106. PIESCU, A. 633.15:581.143.26.03
Putem grăbi coacerea porumbului? (**Is it possible to accelerate the ripening of maize?**)
Viaţa Agric. 1934: **25**: 77–80.
The principles of Lyssenko's method of vernalization are briefly discussed. Some experiments made by a Rumanian experiment station on maize were inconclusive but there were indications in favour of the treated plants.

107. SĂVULESCU, T. and RAYSS, T. 633.15–2.484–1.521.6
Putrezirea uscată a ştiuleţilor de porumb în România. (**Dry rot of the ears of maize in Rumania.**)
Anal. Inst. Cerc. Agron. Român. 1933: **5**: Anul 4: 3–112.

SĂVULESCU, T. and RAYSS, T. 633.15–2.484–1.521.6
Putrezirea uscată a ştiuleţilor de porumb producă de *Nigrospora Oryzae* (B. et Br.) Petch. [**Dry rot of the ears of maize produced by *Nigrospora Oryzae* (B. et Br.) Petch.**]
Viaţa Agric. 1934: **25**: 37–46.
A detailed study of *Nigrospora Oryzae* and its distribution in Rumania, which includes the specific resistance of the varieties of maize grown in the country and the suggested methods for control; these include the cultivation of resistant varieties and pure lines.

108. 633.15–2.484–1.521.6
SOMERS, L. A. 635.67–2.484–1.521.6
Report of work with hybrid sweet corn in 1933.
Trans. Ill. Hort. Soc. 1933: **67**: 406–12.
Tests for resistance to Stewart's disease (wilt) shewed that the late hybrid sweet corn, Golden Cross Bantam though not immune was highly resistant, it exceeded other varieties in yield and was remarkably uniform. Top Cross Bantam, 3–4 days earlier than Golden Cross Bantam, though inferior to it in every other way, is distinctly superior to most commercial strains.

109. HOLBERT, J. R., FLINT, W. P. and BIGGER, J. H. 633.15–2.7–1.521.6:575.14
Chinch bug resistance in corn—an inherited character.
J. Econ. Ent. 1934: **27**: 121-24.
A number of inbred lines and hybrids of maize developed during a period of over 15 years in Illinois were subjected with similar experimental material from other states in 1933 to severe chinch bug infestation.

The results of this one year of study seem to indicate that some inbred lines carry dominant factors for chinch bug resistance while other inbred lines carry dominant factors for susceptibility. It also seems possible that strains of corn may be developed combining chinch bug resistance with good economic qualities.

BARLEY 633.16

110. 633.16(53)
633.16–2.112–1.521.6
633.16:575"793"

ORLOV, A. A.

(Barleys of Arabia.)

Bull. Appl. Bot. Leningrad 1934 : Ser. 5 (2) : 1–40.

The observations were carried out on 14 samples of barley obtained from various parts of Hejaz and Yemen and have revealed the presence of a great variety of botanical forms, especially of the two-rowed barleys. The greatest number of varieties was found in the neighbourhood of Sana in Yemen, including members of all three subspecies. The varietal composition of the other parts of the country is given, as far as the material would permit. The regional distribution is peculiar in that the zones of greatest altitude are characterized by the greatest variety of forms. The var. *deficiens* is the most common, together with var. *nutans* and var. *pallidum*.

With the exception of Abyssinia and Eritrea the number of varieties present is greater than in any other country, though the number of forms representing each variety is much smaller than in Abyssinia.

These barleys as a group are characterized by their extreme earliness (55–60 days), very thin (2·0 mm.) and short (40–50 cm.) straw, good leaf production, large grain and drought resistance and are classed as a distinct ecotype *arabicum*. Certain barleys representing certain other ecotypes, especially *abyssinicum* and *indicum*, occur among them as admixtures. Moreover, the preponderant var. *deficiens* resembles the *deficiens* of Abyssinia and Eritrea and differs from those of the Caucasus in the absence of the glume on the lateral spikelets. A variety previously regarded as endemic to Abyssinia and Eritea, var *Steudelii*, was also found. The varieties *nutans* and *medicum*, rare and absent respectively in Abyssinia, are the typical varieties of Asia Minor ; these have given rise to the main ecological types of Arabian barleys. The general character of the Indian barleys makes it clear that the common forms have entered India from Arabia and not conversely. Thus Arabia is seen to be an important centre of form development within the species *Hordeum sativum*. Before the separation of the African continent barley must have been present in the region which has now become Abyssinia on the one hand and Arabia on the other. In Abyssinia evolution has progressed along specialized lines owing to the peculiar nature of the climatic conditions. In Arabia the original barleys have evidently been supplemented by immigrant forms from Asia Minor. The study of this material has for the first time shewn the relationship of the barleys of Abyssinia and Eritrea with the Asiatic group.

These barleys possess a number of agronomically important characters such as high yield, earliness, large grain and drought resistance. In variety tests of the whole world collection in 1930 they exceeded the standards in yield, though they were inferior to the varieties of Asia Minor. Their high yield is the result of vigorous tillering and high 1,000 grain weight, in which latter quality they exceed even the Mediterranean barleys. On the other hand their somewhat coarse husk reduces their bushel weight. They are non-shattering and non-shedding and relatively disease resistant, and though their straw is very short their many desirable characters, in particular the unusual combination of high yield and earliness, make them exceedingly valuable material for breeding. Their earliness is expressed both in time of earing and time of ripening, especially in dry years, which therefore do not impair their yield. They complete the first stage in 32–34 days, the second in 24–29, having a total vegetative period of 57–60 days. These, therefore, together with the barleys of Cyprus, are the earliest barley varieties known, the next in order of earliness being those from Egypt and India (62 days) and from the Afghan mountains (63). The barleys from all other regions are 22–29 or even more days

later. A further valuable feature is that the naked forms are as drought-resistant as the hulled forms, whereas in other groups the naked forms have considerably higher water requirements. The grain from Arabia is low in protein and of good malting quality, though when grown in the U.S.S.R. the protein content rises.
A key for the determination of the varieties cultivated in Arabia is given, with indications of the localities in which they occur.

111. Barbacki, S. 633.16:581.192:575.11
Z badań nad jęczmieniem. Cz. III Zmienność i dziedziczenie zawartości azotu w ziarnie czystych linij i mieszańców. (**Studies on barley. III. Variability and inheritance of nitrogen content of the grain of pure lines and hybrids.**)
Mém. Inst. Polon. Éc. Rur. 1933 : **14** : 150–57.
The inheritance of nitrogen content of the grain was studied in a cross between two and six-rowed European barleys, *Hordeum* c. a. *distichum nutans* Att. and *H.* c. a. *polystichum vulgare* Att. with a low nitrogen content and a six-rowed barley, *H.* c. a. *nigronudum* Att. from the Himalayas with a relatively high nitrogen content. Low nitrogen content was dominant in F_1 and there was segregation in F_2 with transgression, most noticeable in the direction of low nitrogen. The variations of the 2-rowed parent were 2.12–2.69 per cent and for the F_1 hybrids 1.43–3.04 per cent and transgression in both directions was observed up to F_6.
The relations between nitrogen content of the grain and a number of morphological characters were investigated and it was found that there was a certain amount of association but that in general it was not close. Among other correlations the six-rowed barleys had a lower nitrogen content of their grain. Selection for nitrogen content may be made in the F_2 but is better made in later generations.
The soil exerted a considerable influence on the nitrogen content of the grain under given climatic conditions.

112. 633.16–1.557:519.24
Immer, F. R., Hayes, H. K. and Powers, L. 633.16–1.557:575.3
Statistic determination of barley varietal adaptation.
J. Amer. Soc. Agron. 1934 : **26** : 403–19.
The chief interest of this study of the yields of 10 varieties of barley grown at 6 different stations in each of two years, is to illustrate the detailed working of Fisher's analysis of variance procedure in such complex cases. Each experiment was set out in randomized blocks and analysis of the composite data enables the effect of varieties, stations and years and the various interactions of these factors to be worked out. It is shewn that some varieties react differently in different stations and in different years, while the general superiority of certain of the varieties was established. J. W.

113. 633.16–1.557:575.11
Barbacki, S. 633.16:575.116.1
Z badań nad jęczmieniem. Cz. II. Zmienność i dziedziczenie niektórych cech fizjologicznych. Selekcyjna ważność cech. (**Studies on barley. II. Variability and inheritance of some physiological characters. The importance of breeding characters.**)
Mém. Inst. Polon. Éc. Rur. 1930 : **11** : 579–610.
The plants used in these experiments were a two-rowed barley of the Hanna Proskowetz type (Hordeum c.a. *distichum nutans* Att.) and two six-rowed barleys (*H.* c.a. *polystichum vulgare* Att. and H. c. *nigronudum* Att.).
The most variable characters were yield and tillering, with coefficients of variability of 36·71 and 30·83 respectively. Much less variable were 1000 grain weight, length of ear, number of spikelets, length of awns and length of straw.
On the whole the six-rowed barleys were rather less variable than the two-rowed. Yield was determined by several cumulative characters. At least 2–3 cumulative characters are concerned

with 1000 grain weight in the six-rowed forms. One main factor determines earliness but other minor cumulative factors also affect this character.
Linkage was found between type of ear and 1000 grain weight and a less marked linkage was observed between type of ear and time of heading, the six-rowed hybrids being somewhat earlier than those with two rows.
Length of spike in the first place and density in the second are considered as characters of primary importance in selection for yield.

114. 633.16–2.111–1.521.6:575
CONSTANTINESCU, E. 633.16–2.111–1.521.6:578.081
Die Kältefestigkeit verschiedener Wintergersten. (**The cold resistance of various winter barleys.**)
Z. Züchtung 1934 : A **19** : 439–53.
A study of the various direct and indirect methods available to the breeder for the investigation of cold resistance in his experimental material.
The winterhardiness of 22 varieties of winter barleys was tested by : winter field tests, artificial freezing, refractrometric determination of the dry matter, estimation of the sugar content, osmotic pressure determination, pH and electrical conductivity. The results shewed that a good estimation of the winterhardiness of the varieties could be obtained by the methods of (1) artificial freezing, (2) estimation of the electrical conductivity of the cell sap, and (3) determination of the osmotic pressure values.
By the estimation of the conductivity varieties can be distinguished which differ but slightly in cold resistance.
The very slight differences that distinguish barleys in regard to winterhardiness forms one of the difficulties of the breeder of this crop. Owing to the fact that the majority of barley varieties at present used in breeding are more or less related and also derived from parents whose original habitat was climatically mild, no marked advance in winterhardiness (*i.e.* beyond the usual transgressive inheritance) need be expected unless varieties of superior resistance are found and used for hybridization.
Another difficulty in barley breeding for cold resistance is the variability of the results, which is due probably to the fact that in actual fact a barley sort represents a mechanical mixture of morphologically similar lines.

SORGHUM 633.17

115. 633.174:575.11.061.6
KARPER, R. E. 633.62:575.061.6
Maternal inheritance of chlorophyll in sorghum.
J. Hered. 1934 : **25** : 49–54.
Two distinct types of striped variegation, green and white and green and yellow, found in several varieties of sorghum, have proved to be transmitted to the progeny only through the female parent. Striped plants produce normal green, striped green and yellow or green and white, and pure yellow or pure white seedlings. The green plants produce normal green offspring, the yellow and white plants die in the seedling stage and the striped plants repeat the performance of the parents.
It was also experimentally established that the chlorophyll deficient types arise from definite areas and are not distributed at random on the ear of striped plants. Moreover a direct correlation was found between the nature of the maternal tissue and the kind of seedlings it produces, *e.g.* only seeds from chlorophyll deficient areas gave yellow or striped progeny. Furthermore, the pattern outline of chlorophyll deficient tissue in the parent ear can be observed and the type of progeny closely though not exactly predicted.
The author is inclined to the view that the plastids are the carriers of this type of maternal inheritance and therefore the type of progeny is determined by the nature of the maternal tissue rather than by the chromosomes.
Certain other unexpected albino and yellow chlorophyll deficiencies in cultures under investigation are thought to be possibly due to mutation.

RICE 633.18

116. Reyes, G. M., Borja, V. and Torres, J. P. 633.18:581.162.5(91.4)
Observations on two forms of sterility in rice.
Philipp. J. Agric. 1933 : **4** : 99–118.

Two types of sterility prevalent in Manila are discussed : (1) " white sterility," characterized by the presence in the panicle of undeveloped, empty, white florets occurring usually in groups in the terminal parts, and (2) cross sterility which is marked by the formation of empty, straw coloured floral glumes among the normally developed grains in the panicle ; the flowers apparently contain complete sex organs. This latter type of sterility is believed to be an hereditary character arising through natural or artificial crossing of varieties with widely different morphological characteristics or of genetically widely divergent parents. Evidence of cross sterility in natural and artificial rice hybrids is cited and the hereditary nature of semi-sterility in such hybrids is inferred.

Varietal susceptibility to the defect and the possible effects of climatic and other factors upon its incidence should be investigated.

633.18:581.331.23
117. Reyes, G. M. 633.18:581.331.2
Germination of the pollen of rice and pollen tube growth.
Philipp. J. Agric. 1934 : **5** : 21–29.

These experiments to induce development of the pollen tubes of rice in artificial cultures in various media formed part of an investigation on a form of sterility in certain rice varieties. The hanging-drop method of culture was used. The morphological characteristics of normal rice pollen were examined in some detail before cultures were made.

Germination proved difficult to induce and important factors for success appear to be :—(1) the use of fresh material actually in the field ; (2) selection of the proper stage, when the panicle is normal in every respect with the yellow anthers nearly ripe or fully extended within the glumes ; (3) use of the right medium ; (4) strict asepsis.

The pollen grains are most viable about 9 and 10 a.m. and sowings made in the morning in artificial media gave better results than at other times of day. Under Alabang conditions, anthers taken from normal flowers about to open between 8 and 11 a.m. on a bright day, when forced open, dehisce almost instantly and the grains fall freely by their own weight, thus facilitating their sowing on any medium.

ROOTS AND TUBERS 633.4

118. Okonogi, E. 633.42:575.127.2
Natural crossing between *Brassica pekinensis* and *B. Napus*.
Agric. Hort. Japan 1934 : **9** : 1095–1100.

Brassica pekinensis Rupr. and *B. Napus* L. were planted in alternate rows to allow of natural crossing.

The percentages of hybrids in 50,025 plants from the *pekinensis* seed and 60,534 plants from the *Napus* seed were 2 per cent and 10 per cent respectively, *i.e.* the cross of *B. Napus* by *B. pekinensis* is more frequent than its reciprocal. In *Napus* seed the interspecific hybrid seed shewed a definite tendency to be smaller than non-hybrid seed. A considerable portion of the hybrid seed could therefore, if desired, be eliminated by sieving. No such relationship was however apparent in *pekinensis* seed.

It is suggested that somewhat similar relations may exist between all the species of *Brassica* with 10 chromosomes as the haploid number and *B. Napus*.

633.491(82)
119. Bukasov, S. M. 633.491:575(47)
(The great crisis in potato breeding.)
Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 51–60.

The most recent expedition to South America has discovered still further new species and forms of cultivated potatoes especially in Ecuador, which was not included in the earlier expeditions. Three new species, *Solanum Kesselbrenneri*, *S. riobambense* (chaucha chuga) and *S. cuencanum* have been found, displaying features intermediate between the Peruvian and

Colombian species. The South Peruvian species *S. stenotomum* and *S. chocclo* are also present in Ecuador. The name chauca is applied to *S. riobambense*, a very characteristic species ; the true *S. chauca* is absent in Ecuador. *S. andigenum*, as in all other neighbouring countries, is very prevalent but occurs in the form of a number of characteristic local varieties.

In Peru a new species *S. pauciflorum* has been found, bearing certain characters associated with the frost-resistant hybrid species *S. Juzepczukii* (triploid) and *S. curtilobum* (pentaploid), in whose origin it has probably participated.

S. tuberosum has been found in the lowlands of most of the countries bordering the Atlantic but these are all adventive forms and in the mountain regions this species is entirely absent.

Various new wild forms have been obtained through the United States Department of Agriculture from Mexico, including a variety of forms of *S. demissum*, new varieties of the blight-resistant species *S. Antipoviczii* and *S. ajuscoense* and the three blight-immune species *S. verrucosum*, *S. polyadenium* and *S. bulbocastanum*, known previously only from herbarium specimens. New varieties of the frost resistant species *S. acaule* have been brought from the mountains of Argentina, together with the allied species *S. Commersonii* and *S. Ohrondii* and specimens of *S. chacoense*.

In the rainless regions of Peru two extremely interesting wild species *S. medians* and *S. Vavilovii* were found, differing one from the other in a number of respects but both possessed of extreme drought resistance.

In crosses between two susceptible parents segregates resistant to frost and blight have appeared and high yielding plants have been obtained by crossing two wild species devoid of tubers. Forms not inferior to the standard cultivated varieties in yield have been obtained from selfed progeny of *S. andigenum*. Crosses to the number of 20,000 involving different specific combinations and also a number of back-crosses have been carried out. Many of the F_1 hybrids of *S. tuberosum* and *S. andigenum* are characterized by quite high yields, which in later generations often diminish. These hybrids were equal and often superior to the standard cultivated varieties in other qualities too. The starch content in many of them is over 20 per cent and in certain cases even goes up to 28 per cent ; yields of up to 1,300 g. per plant from 2 kilo. of tubers have been obtained near Leningrad.

Use is being made of the native Chilean races of *S. tuberosum* and the allied species *S. leptostigma* Juz. and *S. Molinae* Juz. (syn. *S. Fonckii*). Hybrids of *S. tuberosum* x *S. leptostigma* gave high yields and were resistant to blight, though neither of the parents possessed resistance. Some of the blight-resistant hybrids of *S. demissum* have a fairly high yield but will be back-crossed with *S. tuberosum* to improve both yield and quality.

S. Kesselbrenneri and *S. riobambense* from Ecuador share with *S. Rybinii* and *S. boyacense* the quality of rapid germination of the tubers, which is one of the means of increasing earliness, since most of the native potatoes are rather late, especially under long day conditions, and rather exacting as regards temperature. *S. Rybinii* is being extensively used in crossing also on account of its marked resistance to virus diseases.

The infertility of most of the hybrids of the frost-resistant species *S. acaule* has led to its being placed in a distinct sub-group *Acaulia*. It has this year been crossed successfully both with *S. tuberosum* and *S. andigenum* but the hybrids are again sterile. The same is true of the triploid frost resistant cultivated species *S. Juzepczukii* which may also have to be transferred to the section *Acaulia*. On the other hand hybrids of the frost-resistant species *S. curtilobum* are very promising, and some of them have given yields of 900 g. per plant, with a starch content of 26 per cent, and they are frost-resistant. By crossing the hybrids with the cultivated variety Epicure, better results still have been obtained, *e.g.* up to 2,500 g. per plant (= over 500 c. per ha.). Successful crosses of members of the section *Tuberosa* with other sections have been made however, as for example the frost-resistant *S. Commersonii* (section *Pinnatisecta*), which has been crossed with *S. neoantipoviczii* (blight-resistant). Other members of *Pinnatisecta* may therefore be of interest for breeding too, *e.g. S. polyadedium*, *S. coyoacanum* and *S. bulbocastanum*.

Many of the Chilean varieties of *S. tuberosum* are sterile and the question of sterility is being investigated.

Rybin's method of mass cytological investigation has made it possible to examine an enormous amount of material. Chromosome counts have been made of the following new species : *S.*

Kesselbrenneri and *S. cuencanum* 2n = 24, *S. riobambense* 2n = 36, certain new forms of *S. stenotomum*, 2n = 36 and *S. Vavilovii* 2n = 24.
The action of long day in preventing tuber formation in many of the wild species is counteracted not only by low temperature but apparently also by dry conditions of growth.
Investigations are also in progress on the anatomy of the form of the starch grains with different species, the physiology of dormancy of the tubers and the conditions (temperature, light, etc.) required for germination of seeds and sprouting of tubers in the different species.

120. RATHLEF, H. VON 633.491:575.1.061.6
The flesh color of the potato.
Amer. Pot. J. 1934 : **11** : 180–84.
German potato breeders lay the greatest emphasis on their production of wart resistant yellow fleshed tubers of the " Industry " type and of good yielding capacity. Other countries (*e.g.* England and America) prefer the white fleshed forms.
According to the author published analyses of inheritance of flesh colour are few and deal only with European and N. American material and the importance of a knowledge of pollen viability and of the genetic basis of flesh colour in breeding the desired types is pointed out.
Crosses were made between Jubel (Richter) which is white fleshed and was used as the seed parent and three Peruvian varieties as pollen parents, two of which were white and the third yellow fleshed, San Gregorio. The last named produced a large percentage of yellow fleshed seedlings. Of the two white fleshed, one a clone of the Peruvian variety, Pucaniana (Red Maiden) which is very variable produced a considerable number of seedlings with snow-white flesh ; the other, only normal, not quite pure yellow and white flesh-coloured tubers. Since the two Peruvian types were chosen for their skin and blossom colour and not for their flesh colour, these breeding results are regarded as indicating that the genetic basis for these valuable flesh colour characteristics must be widespread in the local forms in question.
From these results and also in view of the great variability and multiplicity of forms in various large collections of Peruvian forms the writer believes that more than one factor must be assumed to condition yellow flesh and that one factor also must be postulated for the undesirable greyish-green that occurs in *Solanum tuberosum*. The latter factor is also present in many Peruvian varieties and possibly also in European ones that are not always snow-white : also a further yellow factor must also be concerned in the production of the intense yellow flesh colour in varieties such as the Peruvian Naranjito (Little Orange) and the Lucci forms of the Upper Andes—apparently equivalent to the cultivated species *S. ajanhuiri* Juz. et. Buk. described by the Russians (see " Plant Breeding Abstracts," Vol. IV, Absts. 1015, 1017).
In conclusion it is suggested that a study of the chemistry of pigment in the potato and of the plant as a whole and a study of its morphology and ontogeny would be of value to the breeder.

121. 633.491:575.11
RATHLEF, H. VON and SIEBENEICK, H. 633.491:575.11.061.6
Über einige Kreuzungen peruanischer Sorten von *Solanum andigenum* Juz. et Buk. mit Richters Jubel und die Genetik von Schalenfarbe, Knollenfarbe, Fleischfarbe, Blütenfarbe und Knollenform bei der Kartoffel. (**On some crosses of Peruvian sorts of *S. andigenum* Juz. et Buk. with Richter's Jubel and the genetics of colour of skin, tuber, flesh and flower and of tuber shape in the potato.**)
Genetica 1934 : **16** : 153–76.
Crosses were made in which Jubel, which is recessive for most factors or appears so, served as the maternal parent while as the paternal parent three different Peruvian varieties, one yellow skinned, another red spotted with red eyes and another similar form with blue pigment were used.
In the three progenies raised the terminally flattened shape of the tuber characteristic of Jubel scarcely appears at all. Moreover it would seem that the recessive characters of Jubel have been replaced by dominant characters (or epistatic as the case may be) of the Peruvian sorts. Though the factorial basis for tuber shape and depth of eye could not be elucidated, intermediate

inheritance of shape was evident, whilst seedlings with shallow eyes formed the smallest group in each cross.
Bartosch's assumption of polymeric factor series for tuber length is regarded as likely and 2–3 allelomorphs would, it is suggested, explain the general predominance of oval and round forms in these crosses.
The question of colour of skin, eye, seedling and flower is discussed from the biochemical aspect and in the light of previous workers' results which are conveniently tabulated. The writer concludes that the analogy between the genetic facts and the chemical properties of the potato pigments tends to support the view that the genes represent potencies of chemical substances in solution and further investigation of this problem is needed.
All three combinations shewed the tendency of the formation of very numerous tubers, and thus many of low economic value ; though seedlings of high yield could also be obtained from certain of the progenies.
The superior characteristics pertaining to flavour were transmitted by the Peruvian sorts and the table qualities of Jubel were definitely improved by the crosses.
In general, most of the genes in the Peruvian types are also present in the European forms but, in the latter, members of the allelomorphic series often occur isolated and the original complex condition is disturbed. Certain dominants appear to have completely vanished from the European types.

122. Semsroth, H. 633.491:581.162.3.056
Der Einfluss der Witterung auf den Beerenansatz bei künstlicher Befruchtung der Kartoffelblüte. (**The influence of the weather on berry setting in artifical pollination of potato flowers.**)
Pflanzenbau. 1934 : **10** : 471–78.
In view of the importance to the breeder of knowing the best conditions for a good set of berries in the artificial pollination of the potato it is surprising that the literature on the subject should be so scanty. The present paper represents an attempt of the author in part to remedy the situation. As a result of his investigations he found that for a good set the daily average temperature should be low (about 18·7°C) with a very low average maximum temperature (about 22·5°C) and a high relative air humidity (about 79 per cent). A bad set results from high average daily temperature (about 21°C) a very low minimum and a high maximum temperature, a low relative air humidity and heavy showers on the days of emasculation and pollination.
Of these factors, the humidity of the air is perhaps the most important.

FIBRES 633.5

123. Varuntsjan, I. S. 633.51 *G. barbadense*
(**Varieties of Egyptian cotton.**)
Bull. (Trudy) ZakNIHI Pop. Sci. Ser. 29 : 1933 : pp. 51.
After a brief discussion of the value of the Egyptian cottons and the history of their cultivation the author refers to the work of the Soviet breeders in demonstrating the possibility of their acclimatization in the Soviet Union and the selection of strains suitable for cultivation there. Indications are given of the cultural measures necessary to grow these cottons and then follows a botanical description of the Egyptian cottons as a group and of the main varieties individually.

124. Ryshkov, E. and Mazo, E. 633.51(47)
[**Botanical and economical characteristics of cotton varieties bred at ZakNIHI (Transcaucasia).**]
Transcaucasian Cot. Res. Inst. (ZakNIHI) 1933 : No. 37 : pp. 126.
A bulletin giving morphological descriptions and illustrations of the new lines of cotton selected by ZakNIHI, and of certain standard forms, with very brief indications of the agronomic characteristics, which is to form the subject of a separate work, and of the lint qualities. The varieties are divided into six groups according to time of maturity. Indications are also given of correlations existing between certain morphological characters and degree of earliness.

125. LAIKOV, V. V. 633.51:677.21(47)
(**Quality of Soviet cotton from newly selected varieties.**)
New varieties and species of cotton and their utilization. Part I.
Publications N.I.T.I. Moscow 1932 : 80–117.

Studies were made of the spinning qualities of a number of the best improved cotton varieties grown in the U.S.S.R. First the Lower Egyptian cottons of the Pima type are considered, various samples of each variety grown under different conditions being compared one with the other. The Upper Egyptian types are next considered, including Ashmouni and similar cottons, followed by the Uplands, then the varieties with medium staple, considered in order of their earliness.

The observations shew that by transplanting it is possible to grow high quality Egyptian varieties in the region of Tashkent, Pima selections spinning as high as 120 counts. For spinning 50's and 60's the long stapled Uplands are as good as the Egyptians and are from the cultivator's point of view superior. The variety Triumph Navrotskii was variable but spun 40's and so still deserves attention.

The spinning data for the different varieties in 1928 and 1929 are tabulated.

126. TAMMES, T. 633.52:581.48:575.1.016.63
Die Übereinstimmung zwischen Entwicklungsstadien und Phaenotypen verschiedener Genotypen. (**The conformity between developmental stages and phenotypes of different genotypes.**)
Genetica 1934 : **15** : 519–28.

The seeds of flax, *Linum usitatissimum*, may be either uniformly coloured or they may shew various degrees of parti-coloration.

The seeds of one plant do not all shew the same degree of parti-coloration but all stages may be present. As a result of investigations on plants selfed for several generations it was found that considerable inherited difference existed.

The heritable difference was expressed in two ways, firstly in the relation of the size of the light and dark areas of the tests and secondly in the proportion of uniformly and parti-colored seeds in an individual plant.

A study of the developmental stages of the seeds shewed that they passed through all the stages from no colour to uniformly coloured and it is suggested that the different degrees of coloration observed are physiological and are due to a slowing up of the colour-forming reaction, which leads to quantitative differences. These results shew a certain agreement with the phenomena of sexuality in *Lymantria dispar* studied by Goldschmidt.

127. MEDWEDEWA, G. B. 633.522:576.354.4:581.331.2
Zur Zytologie des Hanfes. Die Pollenentwicklung beim italienischen Hanfe. (**On the cytology of hemp. Pollen development in Italian hemp.**)
Genetica 1934 : **15** : 353–91.

In opposition to McPhee (1924) the author found many cytological and other aberrations in microsporogenesis and pollen formation in Italian hemp grown in the vicinity of Moscow. The author attributes the marked irregularities in the reduction division to the abnormal cultural conditions for southern hemp in the northern region, and especially to the action of frost on the developing germ cells. Confirmatory tests by growing Russian and Italian hemp in their respective habitats under optimum conditions would, however, be necessary.

The possible role played by plant migration and transplantation for cultivation from one climatic region to another in species formation is pointed out.

SUGAR PLANTS 633.6

128. MEDINA, V. 633.61:575(85)
Informe del Ayudante de la Sección Caña. (**Report of the Assistant to the Cane Section.**)
Estac. Expt. Agric. Soc. Nac. Agrar. Lima 1930 : Informe No. 18 : pp. 15.

The cane commonly cultivated, Bourbon, is deficient in several respects and collections have been made of the best canes of other countries in the hope of supplanting it. Crosses have also been made, without success, but the work of hybridization is to be continued at more favourable altitudes.

The methods of carrying out the variety trials are fully described.

129. 633.61:575.127.5

*Rümke, C. L. 633.61:575.127.5:576.354.46

Saccharum-Erianthus bastaarden. (*Saccharum-Erianthus* **hybrids.**)

Arch. Suikerind. Ned.-Ind. **1934**: No. 7: 211–63.

The use of wild canes in crossing with sugarcane is traced in some detail, with abundant quotations, shewing how from crosses of " noble " canes with wild canes new canes have been produced that greatly exceed the original noble parent in yield and sugar content as well as in disease resistance.

The very rare occurrence of simultaneous flowering of *S. officinarum* (Clone EK28) and *Erianthus* species in November 1927 was the occasion of effecting the present crosses. Various *Erianthus* species were used but only *E. sara* succeeded, and only with sugarcane as the female parent. A full description is given, with illustrations, of the main characters of the species *Erianthus sara* (syn. *S. sara* Roxb., *S. munja* Roxb. and *S. ciliare* Anderss.) and the grounds are given on which it is regarded as a species of *Erianthus*. The features which distinguish it from allied species of *Erianthus* are also given. A description is given of the sugar-cane EK28 and a table shews the points of distinction between *S. officinarum* and *E. sara*.

Two arrows of EK28 were pollinated with *E sara* in 1927. The seed of one failed to germinate, the other gave 10 plants of which one died, the others seemed to be true hybrids. In the following year three more EK28 arrows were pollinated, this time giving 740 plants, of which 100 soon died and one or two proved to be EK28 selfs. All the remainder were hybrids in type and were maintained vegetatively. Large reciprocal populations were produced but all proved to be selfs of *E. sara*, which was confirmed by their cytology.

Owing to the heterozygous nature of the sugarcane parent the F_1 shewed segregation in such characters as colour, thickness, length and tillering, but in respect of the specific characters it was uniform. It resembled the *Saccharum* parent in some characters and *Erianthus* in others, while others still were intermediate.

Descriptions are given of both the somatic and meiotic divisions of the two parental species and of the hybrids. In *Erianthus* 60 chromosomes were observed in root tip divisions and 30 gemini at meiosis. In EK28, 80 chromosomes were observed in root tips ; at meiosis nearly all chromosomes formed gemini, but multiple associations also occurred, together with univalents which were usually associated in pairs. The gemini in this case were usually end-to-end. There was a clear tendency, as in the *Erianthus* meiosis for the chromosomes to congregate in the vicinity of the nucleolus, in addition to which the gemini were arranged in groups, indicating secondary pairing. The grouping moreover was generally almost identical in the two corresponding anaphase plates. The univalents were invariably peripherally disposed.

Dyad and tetrad formation were quite regular and 60 per cent good pollen was produced. The somatic numbers in the hybrids varied from 60 to 70. At meiosis no congregation of the chromosomes around the nucleolus was observable and the univalents were not grouped in pairs but scattered independently through the nucleus. Quadrivalents and other multiple associations were observed more frequently than in EK28 but there were no indications of secondary pairing.

Tetrad formation was on the whole regular, but the anthers in most of the hybrids did not dehisce and the pollen degenerated. The hybrids displaying the least cytological irregularities gave a certain amount of well-formed pollen, up to 30 per cent.

The somatic number of the hybrids was always lower than the sum of the haploid numbers of the two parents, in one hybrid by as much as 8. It would appear from this therefore that the gametes from EK28 having less than the haploid number of chromosomes, owing to irregular separation of univalents, tend to give more fertile zygotes than those with the exact haploid number or an excess. Why no doubling of the chromosomes of *S. officinarum* occurs in this cross, such as occurs in crosses with *S. spontaneum*, will only be made clear by an investigation of the macrosporogenesis, the process of fertilization and of cell division of the embryo in *S. officinarum*.

***A full translation of this paper is on file at the Bureau.**

130. 633.61.00.15(96.9)

Proc. 53rd Ann. Meet. Hawaiian Sugar Planters' Ass. 1933 : pp. 87.

The proceedings, in addition to containing the report of the committee in charge of the experiment station, includes a verbatim record of the discussions. There occur various references to the cane breeding work being carried out in Hawaii.

In the report on the experiment station a review of the present situation is offered. POJ 2364, the mother of POJ 2878, was the first cane with Kassoer blood to be released, and it was first used in crossing in 1928. Later canes used are *S. robustum*, *S. spontaneum* and certain Australian importations. Over 700,000 seedlings have been raised in the period. Three seedlings are of especial interest :

28–1234 (POJ 2364 x 26 C 270), of remarkable vigour under a wide range of conditions and a strong ratooner ;

30–2417 (28–674 x H 456), a half sister of POJ 2878 and resembling H109 in habit and

31–1389 (POJ 2878 x 26 C 270), a fast starter both as plant cane and ratoons, adapted to short cropping and resembling, though more vigorous than, its mother.

Cytological studies have shewn the haploid number of chromosomes in H 109 to be 40, for one variety of *S. spontaneum* (Molokai) 20 and for others 40.

At one of the meetings A. J. MANGELSDORF described the changes that have taken place in the areas planted with the various canes and discussed the results of the various field trials. POJ 36 and POJ 2878 are just coming into the picture, the latter occupying 10,913 ac., an area which has been developed from a single cutting in five years. H. M. L.

131. SCHRIBAUX, E. and SAILLARD, E. 633.63:575

La graine de betterave sucrière de selection (attribution d'un prix de 20,000 francs). [**Selected sugar beet seed (award of 20,000 francs prize.)**]

C.R. Acad. Agric. Fr. 1934 : **20** : 544–49.

A committee administering the grant made in 1916 by the Société des Sucreries et Raffineries Say to promote the production of superior sugar beet seed by selection has now awarded a prize instituted in 1918 to the firms Vilmorin-Andrieux (Paris) and Florimont-Desprez (Cappelle, Nord) whose work has been based on pedigree selection.

Some results of variety tests are given and a promising new variety evolved by Vilmorin-Andrieux is mentioned.

132. BREWBAKER, H. E. 633.63:581.162.3:578.08

Self-fertilization in sugar beets as influenced by type of isolator and other factors.

J. Agric. Res. 1934 : **48** : 323–37.

The disadvantages of the "space isolation" method are pointed out and the literature on other methods is reviewed.

In the present investigation ten different types of bags were used and cloth cages. The plants were mostly selected from commercial varieties, some were from inbred strains.

The relative humidity and temperature within the bags and cages were determined, but no correlation was found between either of these factors and seed setting. The differences in seed setting found in plants isolated by the same type of bag or cage is attributed to heritable differences and this conclusion is borne out by the fact that a higher set of seed was obtained from the inbred strains.

Of the various types of bags used, those made of 30-pound vegetable parchment 5½ feet by 7 inches gave the most satisfactory results, the cages were also quite suitable and the data obtained indicate that these methods of isolation are practicable for intensive genetical work.

133. ESAU, K. 633.63–1.547.4:575

Bolting in sugar beets. A determination of its effect upon the weight and quality of the roots, based on studies in Central California.

Facts ab. Sug. 1934 : **29** : 155–58.

A comparative study of bolters and normal beets made in 1931–32 in California seemed to shew that the percentage of bolting might be reduced by selection and breeding.

134. SEVOST'JANOV, S. P. 633.63.00.14(47)
[Variety tests with beet at the geographical points in the zone of the "Pervomaiskaja" (1st of May) station in 1931.]
Cent. Res. Inst. Sug. Ind. Pervomaiskaja (1st of May) S.S.O.S. Bull. 1933: **6**: pp. 36.
The best results both as regards quality and yield were obtained at most places with the new varieties produced by the station.

STIMULANTS 633.7

135. PALAMARTCHUK, A. I. and YARKIN, S. A. 633.71:575(47)
[Data on the investigation of white-leafed (White Burley types) varieties of tobacco and their hybrids.]
Bull. Inst. Tobac. Ind. U.S.S.R. 1934: No. 110: 79–115.
White Burley being free from the unpleasant flavour which distinguishes the local yellow tobaccos and at the same time giving a large yield consisting of a relatively small number of large leaves, is regarded as a very desirable type. Direct introduction was unsuccessful and in 1927 it was crossed with a number of local varieties of cigarette tobacco. Very few yellow plants occurred in the F_2 and most of these were susceptible to disease, in consideration of which green plants of otherwise desirable type were chosen—*i.e.* vigorous early and mid-early plants with large leaves relatively few in number; 300 such plants were selected. The F_3 from these plants contained a considerable number of yellow plants and those appearing in the families possessed of the greatest number of favourable characters in the most nearly constant form were retained. The F_4 was sown in 1931 and when examined for purity of type proved fairly constant; the hybrids were much more adapted to local conditions than White Burley and resembled the local types. Selection was repeated, to obtain a more or less pure morphological type and further yellow F_3 plants were sown at the same time. In 1932, 89 of the F_5 hybrids together with yellow-leaved varieties from Russia, U.S.A. and Argentina, were planted out in field tests. The number of days from sowing to flowering was observed: the American and Argentine groups were considerably later than the local standard, the hybrids on the whole slightly later, with a mean of 58·7 and 64·4 days respectively in 1931 and 1932, compared with 52·1 for the standard. The hybrids displayed considerable deviation, some of them flowering in 56 days and occasional ones much later than the standard. The behaviour of some families in 1932 was more or less identical with that of 1931, others shewed further splitting, though the differences never exceeded 7 days.
The number of days from sowing to first picking varied in White Burley from 50 to 60 days, in the hybrids from 43 to 60. The final picking in the Russian varieties was on the 83rd day and on the 90th in the standard. The average for the hybrids was 93 but with a variation from 81 to 100 days. Some of the hybrids had the slightly green and coarse tissue characteristic of White Burley, which does not brown so easily as the Soviet varieties, and these were selected. The number of days from the ripening of the first to the last leaf varied from 40 to 47 days in White Burley, 36 to 55 in the hybrids.
The number of plants which had to be rejected owing to poor development was least in the standard and greatest in White Burley; the number was considerably less in the hybrids and in some lines no more than in the standard, shewing that these lines are well adapted to the local conditions. The yields of the various White Burley lines varied from 73·4 per cent to 129·4 per cent of the standard, with an average of 99·6 per cent; the hybrids varied from 61·6 to 137·4 per cent.
The hybrids shewed great variation in height. The number of leaves per plant was 43.45 in the standard, 28 in White Burley and in the hybrids 28, the upper leaves being better developed than in White Burley. The size of the middle leaves in the hybrids was 40·9 x 20·7 and 36·7 x 16·8 cm. in the two years respectively, compared with 36·9 x 15·7 and 49·5 x 19·4

for White Burley and 21·2 x 11·2 and 29·5 x 14·0 respectively for the standard, shewing therefore a very satisfactory increase over the latter.
The greatest diameter covered by the plant is a matter of importance for mechanized cultivation, it varies from 81–100 cm. in White Burley, with an average of 98·2, in the standard 60 to 66·8 with an average of 63·2, and in the hybrids 59·2 to 80·7, average 70·3 ; certain very favourable hybrids with large leaves but small spread were observed. Some of the hybrids with leaves upright in the early stages and spreading only later are of interest.
The standard gave only 1·0 per cent product of the second quality, White Burley 8·6 per cent and some of the hybrids as much as 12·9 per cent.
Preliminary observations on the quality of some of the hybrids shew that they are free from the unpleasant flavour and have a good aroma and studies are to be carried out on the chemical composition of the leaves.

136. PALAMARTCHUK, A. and BOGORODSKI, M. A. 633.71:575.11–18:581.45
(Studies in heredity of some characters in *Nicotiana tabacum* L.)
Bull. Inst. Tobac. Ind. U.S.S.R. 1934 : No. 110 : 43–77.
An extremely early but otherwise undesirable type and a tobacco desirable in every respect but time of maturity served as parents for the cross under investigation.
The F_1 was peculiar in that the number of leaves was almost equal to that of the parent with the lower number. Segregation occurred in the F_2 though forms with low numbers of leaves were still predominant. The variation was greater in the F_1 than in the parental forms and reached a maximum in F_2, where it transgressed the parental limits, reaching a maximum of 55 and minimum of 10 leaves, as compared with 34–48 and 13–15 for the respective parents. The early parent ripened in 51 days, the other in 66. The F_1 again much more closely resembled the early parent, ripening in 49–52 days, and the F_2 had a predominance of early forms, though the parental limits were transgressed in both directions. For the breeder the transgression in the direction of earliness is a very favourable phenomenon.
The sessile type of leaf of the early parent was dominant in F_1 and segregated in F_2, with again a preponderance of the dominant type. The ratio of length to breadth of leaf in the early parent was 1·750 and in the other 2·186, the former being again dominant in the F_1 and prevalent in F_2 though wide segregation occurred. The brittleness of the stem characteristic of the early parent was evident in the F_1, though to a lesser extent, and segregation occurred in the F_2. Height of stem was very much influenced by weather conditions and conclusions as to its inheritance are reserved.
Strong positive correlation existed between numbers of leaves and late flowering. This means that the breeder will not be able to produce forms combining maximum earliness and maximum leaf number but will have to select the optimum combination of these two for any given district. Correlations also existed between brittle stem on the one hand and earliness and leaf number on the other, the early forms with few leaves being the most brittle.
Taking all these facts into consideration the cross in question is evidently not a favourable one for the practical breeder except for the production of the ultra-early forms for northern regions. Considering the leaf number in more detail, the observed distribution is shewn to differ markedly from the theoretical binomial distribution in the excess of the lower numbers, which must therefore be genetically determined. Such a distribution can best be explained by the assumption of 8 pairs of factors, low leaf numbers being dominant. The number of possible gametes is thus 256. It is calculated that each pair of factors in the homozygous state produces 5·48 leaves, over and above a minimum number conditioned by the presence of a basic factor *PP*. In addition to this the presence of a " lethal " factor *AA* is assumed to explain the marked transgression of the parental limits in the second generation, the effect of this factor being to inhibit the action of any factor which occurs adjacent to it in the " chain of factors." The excess of the lower numbers is explained by assuming that when the basic factor *PP* is separated from the recessive promoting factors by one or more of the dominant retarding factors the effect of the former is inhibited.

137. *Kosmodamiansky, V. N. 633.71:575.125:631.557
(Heterosis as a factor increasing the yield of the tobacco crop.)
Bull. Inst. Tobac. Ind. U.S.S.R. 1934: No. 110: 147–60.

In 1931 nine crosses shewed a more luxuriant development in the F_1 than in the parental plants. Increases in length of up to 13 per cent and in breadth of up to 28 per cent occur. Exactly similar results were obtained with regard to height of plant. In 1932 a greater number of hybrids and of characters were examined. No connexion could be detected between the behaviour of one character and another. Most crosses displayed an increase in size though not in every case, and some hybrids even shewed a reduction of certain characters to a value below that of the lower of the two parents. The behaviour of the characters is different in the different crosses. It is necessary therefore to find the cross which gives the most favourable behaviour of the various characters of economic importance. A series of varietal tests was laid out in 1932, with a number of different F_1 hybrids, the results of which are tabulated. In four out of five combinations the yield of the F_1 exceeded that of the higher parent by 5·5 to 16 per cent. One of the combinations was intermediate but was of interest because it transgressed the parental limit of quality and earliness, having 7 per cent more second quality product than the parents and flowering three days earlier than the earlier parent. Out of a total of 22 combinations, four (18 per cent) shewed transgression in the F_1 in yield, nine (41 per cent) in quality and four in earliness. The most promising shewed a yield increase of 16 per cent together with a 6·5 per cent increase in yield of second quality product and earliness and aroma equal to the better parent, whilst an increase of 10 per cent in yield alone is calculated as being more than sufficient to cover the cost of producing the crossed seed.

Similar results were obtained in another lot of experiments mainly of American x Trebizond types. The maximum heterosis was always observed in crosses of the Trebizond group with either American or Dubec, which two latter varieties are thought therefore to represent a group genetically distant from the Trebizond types.

Observations on similar lines were made on salt content, protein content, ratio of carbohydrates to protein and aroma. Though aroma never transgressed the parental limits it was frequently dominant, even in hybrids shewing marked hybrid vigour, a very important consideration from the economic point of view.

The frequency of transgression of the parental limits in the F_1 hybrids is shewn for a number of different characters. Hybrid vigour is regarded as a special case of this transgression which is particularly common in F_1 intraspecific hybrids of *Nicotiana*. The chances of this transgression occurring in the F_2 and later generations are less, owing to their lesser complexity, but certain gene combinations occurring in the F_2 may lead to such transgression which may be perpetuated in the later generations.

138. Sarana, M. O. 633.71:575.127.2:576.312.34
(Cytogenetics of F_1 interspecific hybrids *Nicotiana Tabacum* x *N. glauca* and *N. Tabacum* x *N. sylvestris*.)
Bull. Inst. Tobac. Ind. U.S.S.R. 1934: No. 110: 191–219.

Brief reference is made to the main work of previous investigators, none of whom, however, have viewed the problem from the point of view of practical breeding. The present work was begun in 1926 when crosses were made between *Nicotiana rustica* and a number of other species. Further crosses were made in 1931. By germinating the seeds in Knopp's solution it was possible to raise successful hybrids of difficult crosses, including *N. tabacum* x *Petunia*. Though these latter died at an early stage it is possible that from a greater number and range of crosses successful hybrids may be obtained.

The somatic chromosome number and morphology was examined by the author's special low temperature method (see " Plant Breeding Abstracts," Vol. II, Abst. 393, also Abst. 142 below),

*An abridged translation of this paper is on file at the Bureau.

both in the parents and the hybrids. The chromosomes of *N. glauca* are longer than those of *N. sylvestris* slightly larger than the *N. tabacum* chromosomes. The somatic division in the hybrids was irregular compared with the parents, but it was possible to distinguish the chromosomes of the two species fairly clearly in the hybrid *N. tabacum* x *N. glauca* and also in *N. tabacum* x *N. sylvestris* though in this case less clearly.

In the reduction division 24 units were observed in the hybrid *N. tabacum* x *N. sylvestris*, no clear distinction between univalents and bivalents being possible. Dyads were occasionally formed. Meiosis in the *N. tabacum* x *N. glauca* hybrids was still more irregular but varying numbers of bivalents up to 12 were formed in spite of the size difference between the conjugating chromosomes. The maximum chromosome conjugation was observed only in summer and it is clear that the irregular behaviour is due not only to the numerical difference in the chromosomes but to a deeper disturbance of the physiology both of the nuclear and cytoplasmic constituents of the generative cells. The union of the chromosome threads between the spireme stage and diakinesis, leading to the formation of characteristic bichromosomes, was observed both in the hybrids and the pure species.

Both the pollen grains and ovules of the hybrids were mainly abortive, somewhat more well-formed pollen grains being observed in the cooler season of the year. The pollen was germinated on artificial media and fixed at all stages up to the development of the generative nucleus, the course of which is described in various *Nicotiana* species and the hybrids under discussion. The pollen of the hybrids germinated only with extreme difficulty and much more slowly. The generative nucleus divides in the pollen tube; stages up to late prophase, though not metaphase, were observed but the unusual size of the generative nucleus is suggestive of the large number of chromosomes it contains. The withering of the flower occurred much later on pollinating *N. tabacum* with hybrid pollen than with self pollen, also indicating the reduced speed of germination. Irregular pollen tube development, formation of two or more pollen tubes, etc. was also observed in the hybrids. Flowering in the *N. tabacum* x *N. glauca* was very abundant but most of the flowers died after 10–20 days; no seeds were obtained by bagging. By free pollination of 400 plants 25 seeds developed. A small quantity of seed was formed on pollinating the parent species with hybrid pollen and pollination of 980 hybrid flowers with *N. tabacum* pollen gave 29 seeds. On a very large scale therefore it would be possible to obtain a certain number of fertile hybrids of *N. tabacum* x *N. glauca*. The hybrids of *N. tabacum* x *N. sylvestris* were partially fertile, 350 seeds being obtained by free pollination.

Full details of the morphological characteristics of the hybrids are given in tabular form. Both hybrids grew well and the *N. sylvestris* F_1 shewed marked heterosis in plant height, in number of leaves, and in a number of other characters, others being intermediate. The woodiness and coarse veins of the *N. glauca* hybrids are a definite defect, the *N. sylvestris* hybrids being more desirable in the possession of soft, elastic, hairy leaves. The intermediate character of the root system in the cross with *N. glauca* is interesting from the breeding viewpoint.

As regards the factors influencing quality, the *N. glauca* hybrids contained less alkaloid than either of the parents, the *N. sylvestris* hybrid being intermediate: the alkaloid of the hybrids seems to be a mixture of the specific alkaloids characteristic of the two parents, as witnessed by the reduced melting point of the picrate of the alkaloid and its intermediate colour. In the hybrid of *N. glauca* the nicotine type of of alkaloid is predominant, in the other hybrid the non-volatile alkaloid of the *N. sylvestris* type. The inheritance thus resembles the multiple allelomorphs familiar in connexion with qualitative character inheritance.

The F_1 exceeded both parents in content of essential oil in both crosses, in content of polyphenols in the *N. glauca* hybrid and in total organic acids in the other hybrid. The *N. glauca* hybrid was intermediate in respect of carbohydrate, total nitrogen and salt content and the *N. sylvestris* hybrid was intermediate in content of free bases, carbohydrates and proteins. The F_1 was below both parents in citric acid content in the *N. glauca* hybrid and in resin content in the other hybrid. The flavour as far as can be judged was favourable and characterized by a strong but not unpleasant new aroma and it is anticipated that forms superior to both parents will be isolated from the later generations, especially if care is taken to find the most suitable varieties for crossing.

139. 633.71:575.143:581.162.32
PALAMARTCHUK, A. and BOGORODSKI, M. 578.08:575
(**Cross pollination and its influence on the genotypical composition of hybrid populations.**)
Bull. Inst. Tobac. Ind. U.S.S.R. 1934 : No. 110 : 5–41.

To illustrate the enormous amount of material necessary to carry out successful breeding by the method of pedigree cultures the authors shew that in a cross differing in ten factors the number of F_2 plants necessary to ensure the presence of all possible homozygous segregates, of which there are 1,024, amounts to over one million, and the space required for the work is calculated at 1–10 ha. for the second generation and 50–500 ha. for the third. In any tobacco cross for economic purposes there are at least 10–12 characters to be considered, nearly every one of which is polymeric. The breeder is therefore obliged to limit the F_2 population and carry out selections in the latter generations, thereby entirely losing the advantage claimed for the method—he gains no time and has to make his selections on incomplete material and hence at random.

By the method of bulked populations, selfed for 6–7 generations after which the most desirable lines are selected and tested, it has been possible to select successful types in as little as 5 years where two generations per year can be grown. Numerous examples of the successful application of this method are quoted. The method, moreover, is applicable also to cross-fertilized plants. Calculations are given shewing the proportions of homozygous plants produced in the F_3 from F_2 monohybrid populations in which a certain proportion of cross-pollination takes place. From this the proportion in succeeding generations are calculated. The same principles are extended to the calculation of the proportions for dihybrid and various polyhybrid combinations. Tables are then given of the proportions of homozygotes and the different types of heterozygotes in the several generations from F_1 to F_{10} for different amounts of cross-pollination, in trihybrid and in hexahybrid crosses.

Further tables are given shewing the percentage of homozygotes in the different generations for different degrees of hybridity from mono- to hexahybrid. For all degrees of self-fertilization above zero the percentage of homozygosity in the later generations is greater than that in the F_2 and this difference is greater, the greater the number of factors segregating. Emphasis is laid on the significance of this fact in relation to breeding methods. With the rise in number of factors segregating, the difference in homozygosity made by the addition of one more segregating factor becomes very much less pronounced.

The amount of cross-pollination in tobacco varies very much with conditions, varying in different parts of the U.S.S.R. from 1 per cent to 16–18 per cent but only very occasionally more. The method of bulked populations is applicable therefore, and crosses have been made of all the most promising lines and the F_2's are now sown. The method is thought to be worthy of much more extensive application than it enjoys at present.

140. TOLLENAAR, D. 633.71:575.243
Untersuchungen über Mutation bei Tabak. I. Entstehungsweise und Wesen künstlich erzeugter Gen-Mutanten. (**Investigations on mutation in tobacco. I. Mode of origin and nature of artificially induced gene mutants.**)
Genetica 1934 : **16** : 111–52.

The theoretical implications of the work already reviewed from the practical aspect (see " Plant Breeding Abstracts," Vol. IV, Abst. 1046), are here presented.

Plants of the Kanari strain which was known to be homozygous in all respects and in which no mutant had ever appeared were used as experimental material. The discussion of the results is confined to gene mutations, though chromosome mutations and plasma mutants which occurred much more rarely are mentioned.

A general description is given of the types and numbers (at least 11 per cent) of mutants observed in the F_1 and the fact that there is often no fundamental difference between the recessive, intermediate and dominant forms is exemplified. Typical examples of the monofactorial primary gene mutations observed are described. All were heterozygous and thus occurred only in the haploid phase. A few bifactorial and trifactorial mutants also occurred.

Many mutants shewed ratios deviating from strict Mendelian segregation which are attributed to sterility, inviability of the homozygote, reverse mutations, etc. ; and it was found that ratios in the same plant may vary from day to day and may be considerably influenced by external conditions.
Instances of reverse mutations, arising spontaneously and also as primary or secondary changes, are cited.
The nature of secondary mutations is examined and ultimately defined as "pre-mutation" which is subsequently elicited. Though the number of secondary mutations was relatively low, the process persisted up to the last available generation, F_8. A number of secondary gene mutants are described and the analogy between spontaneous and artificially induced secondary mutations demonstrated. The importance of recognizing the possible effects the labile "pre-mutated" condition in experimental material is emphasized.
An extensive bibliography and illustrations close the paper.

141. 633.71:575.252:576.356.5
SARANA, M. O. 633.71:575.252:575.129
(The amphidiploid combination in F_1 *glauca-Tabacum*.)
Bull. Inst. Tobac. Ind. U.S.S.R. 1934 : No. 110 : 221–24.
A sterile *Nicotiana glauca* x *Nicotiana tabacum* hybrid obtained in 1931 possessed of 36 chromosomes and in no way different from other such hybrids, in 1933 gave a new crop of buds after the ordinary leaves had been shed, most of which, if they produced flowers, were also sterile. One however formed unusually large flowers with abundant pollen, which was larger than that of either of the parents. The pollen germinated well and rapidly on artificial media and most grains produced generative nuclei in the normal way. The diameter of the pollen tubes was also greater than in the parents. The reduction division was much more regular than the F_1, though not without certain irregularities ; 36 chromosomes were present at metaphase. All flowers formed fruits, the later ones more than the earlier ones.
Cuttings were taken and rooted and the chromosome number 72 was counted in the roots. This makes it clear that the shoot in question is an amphidiploid which has arisen by somatic doubling. Reference is made to the tumours observed by Kostoff and others in many *Nicotiana* species and the two are thought to be very closely allied, being both expressions of the incompatability of the plasma of the two species, leading to disturbances in the physiology of the cell ; this, it is thought, is probably responsible also for the above-mentioned irregularities of division in spite of the balanced chromosome number. In this connexion investigations are going to be made on the possible segregation of the progeny and on the economic possibilities of the hybrid.

142. SARANA, M. O. 633.71:576.312.34
(On the karyology of the genus *Nicotiana*.)
Bull. Inst. Tobac. Ind. U.S.S.R. 1934 : No. 110 : 179–90.
Applying to tobacco the method previously used with cereals (see "Plant Breeding Abstracts," Vol. II, Abst. 393) it was found that sudden transference from a temperature of 20–25°C to one of 6–7° effected a considerable shortening of the chromosomes ; this together with Levitsky's special fixative made possible a more detailed examination of their morphology. Fifteen varieties of *Nicotiana tabacum* were examined and the 48 somatic chromosomes could be grouped into 10 types according to length, presence of satellites, etc. Similarly in *N. rustica* 9 types, in *N. sylvestris* 8, *N. glauca* 6, *N. glutinosa* 7, *N. undulata* 5, *N. longiflora* 5 and in *N. alata* 6 were observed. In *Petunia violacea* each of the 7 pairs was distinct. The various chromosomes are illustrated.
The chromosome characteristics of the hybrid *N. longiflora* x *N. alata* indicated its hybrid origin. Observations were also made on tetraploids of *N. tabacum* and of *N. glauca*.
The presence of V-shaped chromosomes of *N. rustica*, *N. paniculata* and *N. glutinosa* suggests that these species are more ancient than *N. longiflora* and *N. undulata* and further investigations are expected to throw light on the origin of *N. tabacum*.

143. East, E. M. 633.71:581.162.5:581.331.23
The reaction of the stigmatic tissue against pollen-tube growth in selfed self-sterile plants.
Proc. Nat. Acad. Sci. Wash. **1934**: **20**: 364–68.
It has been found that the fertility of incompatible matings in *Nicotiana* is increased during the extreme end of the flowering season and also by pollination in the bud about 24-48 hours before the flower is due to open. To elucidate the physiological reactions underlying this increased fertility a careful study was made of pollen-tube growth as shewn in smears and sections at given times after pollination. The evidence thus obtained suggests that :—(1) There are in the stigmatic tissue of the mature flower substances which react with other substances present in the pollen-tube and thus inhibit pollen-tube growth. These substances are not present in the bud but appear during the 24 hour period preceding the opening of the flower. (2) In self-sterility genotypes which are not self-fertile in the bud, the afore-mentioned inhibiting substances are developed earlier. (3) End-season fertility of self-sterile plants is due to their being unable during the last week of the flowering season to produce adequate amounts of the substance causing the incompatibility reaction.
These and other results bearing on the nutritional aspect of the problem corroborate the previous findings (see " Plant Breeding Abstracts," Vol. IV, Absts. 459, 1057), regarding the two major influences affecting pollen-tube growth.

144. 633.71–2.421.1–1.521.6
Ternovsky, M. F. 633.71–2.5–1.521.6
Die Fragen der Immunität bei Vertretern der Gattung *Nicotiana*. (**The problems of immunity in representatives of the genus** *Nicotiana*.)
Züchter **1934**: **6**: 140–44.
The immunity of species of tobacco and *Petunia* to *Orobanche ramosa* L. and to mildew, *Erysiphe cichoriacearum* DC. f *nicotianae* is considered in the present paper.
The representatives of the section *Petunioides* were the most seriously attacked by *Orobanche*. *Petunia hybrida* was also very susceptible. On the whole the species belonging to the *Rustica* section were not as badly attacked as those of the *Petunioides*. All degrees of susceptibility were found among the varieties of *N. Tabacum*, but the following year's tests showed that none were really immune.
For resistance to mildew representatives of *N. Tabacum* and *N. rustica* were used as well as wild and ornamental species and F_1 species hybrids. The susceptible variety Dübek Gaspra was used as a control and the results were as follows :—
All varieties of *N. Tabacum* were attacked by mildew under the conditions of the experiment. Of the seven representatives of *N. rustica*, four were attacked by the fungus : *texana, trigonophylla, jamaicensis,* " White Burley," while three were quite undamaged : *Scabra, humilis,* and *Erbasanta.*
Of the wild growing and ornamental types : *glutinosa, paniculata, glauca, Langsdorffii, sylvestris, alata, Sanderae, noctiflora, plumbaginifolia, longiflora, accuminata, repanda, nudicaulis, australis, fragrans, commutata, Bigelovii, suaveolens.*
N. glauca was attacked to a certain degree and *N. sylvestris* showed a slight attack in the greenhouse, the rest were completely immune to mildew in the field and in the greenhouse. The behaviour of the species hybrids was diverse. The hybrids of *N. Tabacum* x *N. sylvestris* and *N. Tabacum* x *N. glauca* were attacked but to a less extent than the *Tabacum* parent.
The hybrids of *N. glutinosa* x *N. Tabacum*, *N. Tabacum* x *N. Sanderae* and *N. rustica* x *N. Tabacum* were quite free from mildew even in the greenhouse where the conditions were most favourable for attack.
Differences in the size and form of the conidia of the fungus were observed between those on *N. rustica* on the one hand and *N. Tabacum* and *N. sylvestris* on the other, but it was not determined whether different races are involved.
Species crosses therefore represent the only method for breeding immune strains of *N. Tabacum* and various possibilities are briefly discussed.
The value of wild forms for breeding varieties immune to other diseases is pointed out.

145. CHEVALIER, A. 633.73(67.5)
Nouveaux caféiers du Congo belge. (**New coffee species of the Belgian Congo.**)
Rev. Bot. Appl. Agric. Trop. 1934 : **14** : 353–54.
Four new species are mentioned one of which, *Coffea Kivuensis* Lebrun, belongs to the group *C. arabica* and is regarded as of possible promise for cultivation on the mountain districts of Africa.

146. CHARTSCHENKO, N. 633.79:575:578.08
Zur Frage der Methodik der Hopfenzüchtung. (**On the question of the technique of hop breeding.**)
Züchter 1934 : **6** : 113–19.
The present investigation which represents part of a comprehensive scheme for a study of the essentials of hop breeding in the U.S.S.R. is to be regarded a preliminary communication.
The most important character of the hop plant is the resin and a study was made of its constancy in various varieties and in the clones derived from them and of other characters of the female flowers.
It was found that the content of a bitter resin was invariable as was also the shape of the bracts and the yield of seed. The other characters are very variable. The percentage resin content is a very constant character under different conditions.
The physiological characters earliness and productivity were also studied and it was found that they were both quite constant.
No correlation was found between these characters and resin content.
Among the varieties grown it was observed that some of the foreign ones had the highest resin content and the ideal is this character combined with high productivity and earliness to suit the Russian conditions.
A large number of hybrid seedlings are being grown, in spite of the difficulties in hybridization and germination and it is hoped that valuable selections will be obtained from them.
Interesting observations were made on two degenerating female hop plants. In the first case after behaving for two years like a normal female plant in the third year both male and female flowers appeared and in the fourth year the plant was entirely male and finally died.
In the second case among cuttings of a female plant was a plant which did not flower in the first year and in the next assumed the typical appearance of a male plant. Both plants flowered at the usual time. Two other plants female in the first year had male and female flowers in the second. Vegetative propagation of these plants gave only monoecious progeny and a cytological examination is in progress. These plants may have a practical significance as they provide male flowers when the female plants flower.
Very little is known of the practical value of the male plants. The author has found lupulin glands in the male flowers but the quantity of resin is very variable which may affect the character of their progeny.

147. BRETHENOUX 633.79:575.42
L'amélioration des variétés de houblons par la sélection. (**The improvement of varieties of hops by selection.**)
J. Agric. Prat. 1934 : **98** : N.S. **62** : 116–17.
The hop, always vegetatively propagated, is shewing signs of degeneration and crossing experiments have been begun with foreign varieties. The author, however, suggests that selection would prove a more rapidly effective method for improving the local varieties.

148. 633.79:577.845
BRESSMAN, E. N. 575.1:577.8
Inheritance of sex in certain seed plants.
Amer. J. Bot. 1934 : **21** : 328–49.
A review of literature on sex in seed plants is followed by some observations on sex conditions in hops.

An instance is reported of sex reversal in a female hop plant (*Humulus neo-mexicanus*) consisting in the production of a whorl of ♂ flowers and subsequently whorls of ♀ flowers. Among the neuter plants recorded was one bearing peculiar bunches of both male and female flowers—the first plant under control conditions to produce any fruit and possibly a neuter with special genetic constitution.
The frequency of sex reversal and neuter plants in hops and the possible causes of these conditions are considered.
An extensive bibliography concludes this paper.

AROMATIC PLANTS, SPICES, ETC. 633.81/4

149. 633.812:575.127.2
APPL, J. 633.812:577.83:576.356.1
Artkreuzungen, Geschlechtsvererbung und Non-disjunction bei Lippenblütlern aus der Thymiangruppe. (**Species crosses, sex inheritance and non-disjunction in labiate plants of the thyme group.**)
Bl. Pflanzenb. v. Pflanzenz. 1933 : **11** : 51–56.

Crosses between *Origanum majorana* and *Origanum vulgare* have already been described (see "Plant Breeding Abstracts," Vol. III, Abst. 263), and in the present paper the author describes a cross between a strain of *Thymus vulgaris* L. which never produced a stamen and therefore never set seed, and *Thymus ovatus* Mill. with hermaphrodite flowers.
A large number of seeds were obtained and the hybrids were intermediate in most characters. With regard to sex, most of the plants were female, some intermediate (that is with functionless stamens), and a few hermaphrodite. The hybrids were almost completely sterile.
In the autumn of 1930 the author found a plant of wild marjoram, *Origanum vulgare*, which instead of the usual corolla had a second and occasionally even a third calyx, and the stamens were transformed into pistils.
The abnormal flowers were seldom visited by bees and therefore only very few seeds set. Eleven plants were however obtained of which nine had hermaphrodite flowers and two were without stamens or corolla. If it is assumed that non-disjunction is the cause of this proportion and that a hermaphrodite plant has the formula *yy*, by non-disjunction gametes *yy* and *o* will be formed and the latter crossed with a normal gamete will give a zygote of the constitutions *oy* which on selfing will produce 75 per cent hermaphrodite and 25 per cent of plants without corolla.
The progeny of the plants when grown supported the author's hypothesis and the importance of the phenomenon in the production of new and valuable forms is pointed out.

OIL PLANTS 633.85

150. 633.854.78:576.356:576.356.5
KOSTOFF, D. 576.356:576.356.5
A contribution to the meiosis of *Helianthus tuberosus* L.
Z. Züchtung 1934 : A **19** : 429–38.

A consideration of Daniel's Lamarckian views on the mutual influence of stock on scion in interspecific grafts of *H. tuberosus* led the author to investigate the possible existence of irregularities in the meiotic processes in *H. tuberosus* similar to those found in the potato.
The behaviour of the pollen mother cells during meiosis is fully described. Both reduction divisions were irregular and pollen grains with various chromosome numbers were often formed. Gametes from such pollen grains might result in zygotes that were chromosomal aberrants and heteroploid and even polyploid forms.
The possible causes of the meiotic irregularities are considered ; and it is suggested that the formation of polyvalent chromosomes so frequently observed is due to the polyploid nature of the plant. Moreover *H. tuberosus* appears to represent a hexaploid species with the formula either AAAAAA (an autohexaploid), or AAAABB (an amphidiploid of an autotetraploid x a diploid), or AABBCC (an amphitriploid of a trigenom triple hybrid).
Finally, Daniel's interpretation of his investigations on interspecific grafts in *H. tuberosus* is questioned.

151. STOFFELS, E. 633.855.34:575.42(92.1)
Contribution à l'étude de la sélection de l'*Elaeis guineensis* à Sumatra. (**On selection of *Elaeis guineensis* in Sumatra.**)
Rev. Bot. Appl. Agric. Trop. 1934 : **14** : 93–101.

A short note on the morphology and reproductive process in *Elaeis guineensis* and on the history of the oil palm plantations in Sumatra is followed by descriptions of certain types of oil palm in various districts of the island.
As regards breeding, the self-fertilization of selected trees during several generations is recommended in order to obtain homozygous individuals.
The dura Deli type and the variety Lisombe have been subject to selection by planters and some excellent yields of oil have been obtained on various estates. Self-fertilization is to be carried out with these selected trees and the seed used in further breeding work.

RUBBER PLANTS 633.9

152. BARCLAY, C. and GRANTHAM, J. 633.912–1.557:519.24
Statistische methoden bij veld proeven van rubber. (**Statistical methods in field experiments with rubber.**)
Arch. Rubberc. Ned.-Ind. 1933 : **17** : 213–34.

The authors discuss on the basis of a uniformity trial, the best method of calculating the errors of field trials with rubber. Large reductions in standard error can be obtained by the use of Student's method, which is shewn to be identical (for two treatments) with Fisher's method of analysis of variance. With more than two treatments Fisher's methods are recommended. It is shewn that the separate collection of yields from individual replications is essential to a valid estimate of error, and in particular a method proposed by Tengwall and Van der Zijl, which produces very low errors out of a comparison of successive harvest yields from the same area, is seen to be fallacious. J. W.

153. ANGENOT, P. 633.912:581.162.3
Premiers travaux d'amélioration de l'*Hevea Brasiliensis* en Indochine. Pollinisation artificielle. (**Preliminary work on the improvement of *Hevea brasiliensis* in Indo-China. Artificial pollination.**)
Bull. Econ. Indochine. 1934 : **37** : 19–40.

The present work was undertaken with the objects (a) of creating, by crosses between high yielders, controlled families from which *élite* plants might be selected and vegetatively propagated after testing and (b) of making a genetical analysis of the high yielding parents. This paper deals with the methods and results of artificial pollination.
Two methods were used, in one the branches after the removal of the male flowers and those female flowers already opened, were enclosed in gauze bags and the other in which the female flowers were carefully watched and just before they opened the sepals were prised apart, the anther inserted and the flower then closed by a plug of cotton wool.
Apart from cost, the two methods seemed equally good. The average rate of fruit setting was 5·3 per cent. The best time of pollination was between 9 a.m. and 6 p.m. and it was found that the personal factor had a considerable effect on the rate of fruit production. Observations were also made on germination.

154. LOMAN, A. P. 633.913
(**The new rubber plant *Scorzonera tau-saghyz* of the Caucasus.**)
Priroda (Nature) 1933 : No. 2 : 61–63.

A description is given of this new species of the genus, which has a higher rubber content than any plant yet known, yielding a very high quality rubber with comparative ease of extraction. It is also characterized by a remarkable capacity for regeneration.

155. MIEDZYRZECKI, M. CH. 634:581.162.5
Stérilité du pollen chez les arbres fruitiers. (**Sterility of pollen among fruit trees.**)
Casablanca 1934 : pp. 8.

Pollen sterility is briefly described from the standpoint of morphological, cytological and physiological causes. A table is given shewing the germination capacity of the pollen of certain diploid and triploid varieties of apples and pears and some of the known methods of counteracting sterility in fruit trees are mentioned.

156. 634–1.524.2:575
*KOVALEV, N. V. 634:576.16
[**Scientific fruit culture in the U.S.S.R. in the new era. (Summary of recent scientific investigation.)**]
Bull. Appl. Bot. Leningrad 1934 : Ser. A (10) : 67–92.

Special expeditions have been sent to various places to study and collect the wild forms of a number of different fruit trees and the material collected is being studied from the point of view of yield, sterility, suitability to various regions, quality, suitability for use fresh and for canning, transportability, disease resistance, chemical composition, etc. The result is that the range of known variation and thus the possibilities in breeding have been increased in all the fruits studied, particularly in the case of apricots, grapes, almonds, pistachio and *Prunus cerasifera*. Much interest is attached to the related wild species of various cultivated fruits, for instance *Pyrus salicifolia*, one of the most drought-resistant pears with a very deep root system, *P. heterophilla* which grows at altitudes up to 2,300 m. and several other resistant species of wild pear ; similarly *Malus baccata*, whose hybrids are the first apples capable of withstanding the cold of Siberia ; xerophytic dwarf cherries *Cerasus prostrata* and *C. microcarpa* growing up to 3,300 m. and various other species resistant to frost ; apricot species *Armeniaca sibirica* and *A. mandshurica* withstanding –40°C. ; almonds *Amygdalus Fenzliana* and *A. bucharica* characterized by disease resistance and frost resistance ; various species of wild plum tolerant of drought and temperatures of –25°C. A new rosaceous fruit of the group *Prunoideae* has been found in the Far Eastern coastal region, viz. *Plagiospermum chinensis*, and several other trees would appear to have possibilities for use as fruits, *e.g.* several species of *Sorbus*.

Similar studies have been made of collections of small bush fruits, which have been examined in respect of frost resistance, early maturity, late maturity, yield, size of fruit, immunity to disease and various other characters, including for instance compact growth suitable for mechanized harvesting in the case of currants, transportability in strawberries, etc., etc. Among the related wild species, cold resistant mountain brambles have been found, viz. *Rubus Moschus* and *R. kaucasicus*, with large fruits, also a number of drought-resistant species, *R. Anatolicus*, *R. candicans*. The Caucasus contains 15 species of blackberry, in great diversity, and many species of raspberry, some with very large fruits. Great interest is attached also to the currants of the Alma-Ata region and the gooseberries resistant to *Sphaerotheca* in the Altai. Siberia and Central Asia have yielded valuable species and forms of currants, *e.g.* the large-fruited *Ribes nigrum* and also *R. dicusha* and *R. procumbens*, each possessed of a number of favourable qualities. The wild cloudberry yields highly and possesses an exceptionally high vitamin content.

Breeding work with this material was begun three years ago, the object being to augment the range of variety of fruit trees for cultivation, to extend their cultivation towards the north, to get varieties suitable for canning, etc., and for transport, to extend the season by obtaining varieties ripening earlier and later, at the same time restricting the period of bearing of any one variety, and to produce disease-resistant forms. *Fragaria virginiana* and *F. chiloensis* have been successfully crossed with the cultivated strawberries and a successful cross has been made of *F. vesca* and *F. elatior*, also of *F. chiloensis* and *F. elatior*, one hybrid plant of which has given progeny. Hybrids of *F. vesca* have displayed marked heterosis. Successful crosses within

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*** A full summary of this paper is on file at the Bureau.**

the genus *Rubus* have been made, even with parents differing in chromosome number. A successful cross has been made of blackberry (*R. caesius*) with raspberry (*R. idaeus*) and from crosses of European with American raspberries promising hybrids with large fruit and erect compact growth have been obtained. Gooseberry hybrids resistant to *Sphaerotheca* have already been produced, using the American *Grossularia divaricator*, *G. nivea* and *G. cynasbata* and the Altai species *G. acycularis*. Some of these species are valuable also in having a compact growth (*G. nivea*) and being free or almost free from spines.

The ideal parental combinations of species in respect of chromosome number and physiological differentiation are being sought. Tetraploid forms of *Rubus* are no bigger than the diploid, often even smaller, though hexaploids often have very large fruits. Hence forms were taken by Rosanova representing the extremes of those capable of crossing, with the object of producing hexaploid forms. *R. idaeus* and *R. caesius* were chosen for this reason, the first with 7, the second with 14 chromosomes. Several triploid hybrids were obtained, in the progeny of which hexaploids appeared. It has been observed in nature that pentaploids also tend to have large fruits.

In producing apples for the north recourse has been had mainly to the apples of central and western Russia, many of which are suitable, and to hybridization with the wild species *Malus baccata*, *M. prunifolia*, *M. Sargentii*, *M. toringo*, *M. joensis* and *M. pumila*, 26 combinations having been made, using one wild and one cultivated parent; similarly for northern cherries, using especially the wild sour cherry, the steppe cherry *Cerasus fruticosus*, the perennial flowering cherry *Prunus cerasus* var. *semperflorens* and various inter-specific hybrids of Michurin; also the dwarf cherries *P. pumila* and *P. besseyi* and the Japanese frost-resistant *P. japonica* and others, *P. Maximovitchi*, *P. Machaleb*.

For producing plums for the north, various forms from northern Russia, China and parts of Europe are being used, together with *Prunus cerasifera* and the American species *P. nigra*, *P. americana* and various hybrid American varieties. All these are being used in hybridization. Similarly with pears, though the variety of forms available is not so great, use is being made of the eight new varieties of Michurin, hybrids with *Pyrus ussuriensis* and with the Chinese pears and some new hybrids between the cultivated pear and *Pyrus ovoidea*. The northern forms of *P. communis* and *P. ussuriensis* are the most favourable parents. Several hundred crosses have been made between wild and cultivated species, this being the first time pear breeding has been undertaken so far north as Leningrad.

In all ten thousand crosses, the majority of them interspecific, involving twenty combinations, have been made in plums and from these 800 fruits have been obtained. Pear and apple seedlings of 3–4 years of age are now under observation. The apricot hybrids have already borne fruit and the two best are definitely superior to the standard varieties in size of fruit, flavour and colour. Cytological studies have disclosed the existence in *Malus Sargentii*, *M. toringo*, *M. coronaria* var. *joensis* and other species, of forms with extra chromosome sets, tetraploids and triploids. Some of the triploids especially have larger fruits and are commercially promising.

157. 634.1:575.127.5
634.1:575.127.5:634.3

MICHURIN, I. V.

(On intergeneric hybridization.)

Priroda (Nature) 1934: No. **1**: 61–66.

As a result of fifty-nine years' experience in interspecific and intergeneric crossing in fruit trees the author has reached the conclusion that success is attained only in the first year of flowering of the trees used. In the second year, especially if the tree was self-pollinated in the first year, pollination with another species invariably failed. The hybrid seeds mostly tend to germinate immediately and must therefore be sown directly they are picked.

A second generation seedling of the Antonovka apple which flowered in the seventh year, 1932, for the first time was pollinated with a mixture of pollen of different species of stone and bush fruits, including cherry, plum, apricot, peach and currants; three fruits of the apple type were obtained giving 31 seeds. The seeds were very late in germinating and gave seedlings of which two thirds shewed various anomalies. Only ten seedlings survived and most of them were to a certain extent stunted in growth, from which the author concludes that the parental combinations have not been well chosen.

158. Dorsey, M. J. 634.11:575.25
The bud sport situation in pomology.
Trans. Ill. Hort. Soc. 1933 : **67** : 212–24.
The history of bud sports, their genetics and commercial significance are briefly reviewed. The technique of bud sport selection, the concept variety in horticulture and the influence of plant patents are discussed and finally, suggestions on the nomenclature of bud sports are given.

159. Roscoe, M. V. 634.11:576.312.35:576.354.46
Cultivated apple chromosomes.
Science 1934 : **80** : p. 186.
The haploid and diploid numbers of six varieties of apple are recorded ; and these cases (all diploids) are stated to confirm the correlation, previously noted, between diploidy and regularity of chromosomal behaviour in meiosis.

160. Khomentovsky, G. I. 634.11:581.142:575.1
(Contributions to the germinating ability of seeds as resulting from hybridization work on apple trees in 1925-1929).
Sci. Res. Inst. S. Hort. Tree-and-Small Fruit. 1932 : **16** : pp. 67.
In producing apple seedlings for use as root stocks, it is now recognized as essential that the seedlings be as uniform as possible ; this can only be achieved by controlling the parentage of the seedlings. Some parental combinations moreover are found to give more valuable seedlings than others. Germinating capacity is an important quality both in this connexion and in breeding work of all sorts.
In 1924 extensive work was begun at Mleev on crossing between cultivated and wild varieties of apples. After counting the number of seeds obtained from each combination they were sown and counts made of the number that germinated. In this way as many as 60,000 seeds were examined in the course of five years, representing 276 combinations of the 16 maternal and 59 pollen parents. The results are presented in such a way that the influence of a particular variety on the germination of the seeds when employed both as pollen and as seed parent can be assessed.
By aggregating the results of each individual year the difference between one year and another was estimated.
For the entire material over the whole period of investigation the average percentage germinated was 60.8 per cent. Certain of the maternal varieties were always above the average, and some were always below, while others varied from one year to another ; the pollinating varieties could be arranged in similar groups. Moreover the position of the varieties in the groups was with very few exceptions the same when considered as pollinators and when considered as seed parents. A similar grouping can be made for the different combinations of parents, the behaviour of a given combination corresponding largely to that of the constituent varieties considered individually. The results of reciprocal crossings in the 16 cases where they were made were also mainly identical or very similar.
A study of the individual years shewed that certain combinations of parents every year gave seeds no lower in germinating power than the higher of the two parents, others were in every year no higher than the lower of the two parents taken as an average over the whole period, and here again the behaviour of the different combinations corresponds very closely to that of their constituent varieties.
Finally, certain combinations attracted attention by repeatedly giving germinating percentages very much in excess of the 6 averages for the year, and others much lower. The highest germination observed was 95·0 per cent, the lowest 2·4 per cent.
There would seem to be no doubt from these facts that germination capacity is a hereditary character, though its genetical constitution is not yet entirely clear.

Some of the varieties were also subjected to self-pollination, the seeds from which, 750 in number, gave a germination of 66·8 per cent, being in no case less than the corresponding germinating percentage of the cross-pollinated seeds.
There was no correlation between the germination capacities of the seeds and the pollen fertility of a particular variety or the degree of success obtained in crossing a particular combination of varieties.

161. HOWLETT, F. S. 634.11:581.162.3
Pollination of the apple in Ohio.
Bi-m. Bull. Ohio. Agric. Expt. Sta. 1934 : **19** : 65–70.
As a result of 10 years work on apple pollination in Ohio the following report contains a list of 36 varieties which fail to give a full crop when self-pollinated, a list of varieties of no value and those of value for pollination.
The following combinations of related new varieties were found to be fully fruitful :—McIntosh x Cortlan, and McIntosh x Melba and their reciprocals; while the following were unfruitful :—Delicious x Starking and Richared. Northern Spy x Red Spy and Gallia Beauty x Rome Beauty and Red Rome and their reciprocals. Arkansas (Mammoth Black Twig) x Grimes Golden is unfruitful for some undiscovered reason.
A table is given shewing the combinations that are unfruitful because of the disparity in their time of blooming.
Certain precautions in orchard planting are noted and the use of bees as pollinating agents is recommended.

162. MOFFETT, A. A. 634.13:576.354.4
Cytological studies in cultivated pears.
Genetica 1934 : **15** : 511–18.
Out of fifteen cultivated varieties of pears examined eleven were diploid (2n = 34) and four triploid. Though secondary pairing occurred at metaphase of meiosis no true multivalents were observed. In triploid varieties associations higher than trivalents were not seen.
The lower degree of secondary pairing in pears as compared with apples indicates a greater degree of differentiation of the pear chromosomes.
The author considers that the evidence points to seven being the primary basic number in pears.
A misinterpretation of the author's views on polyploidy is rectified. (See " Plant Breeding Abstracts," Vol. I, Abst. 24.)

163. 634.22 Florenzia
634.22–2.484–1.521.6
La susina " Florenzia." (**The " Florenzia " plum.**)
Nuova Vita Rur. 1934 : **6** : p. 121.
A further note on this new plum (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 760) which is apparently resistant to *Clasterosporium carpophilum.*

164. RUDLOFF, C. F. 634.22:581.162.3
Die Befruchtungsverhältnisse bei unseren Obstsorten. II. Pflaumen. (**The pollination relations of our fruits. II. Plums.**)
Züchter 1934 : **6** : 121–29.
The results of pollination studies on the plums of the *Domestica* group, which includes almost all the varieties cultivated in Germany, have shewn that both self-fertility and self-sterility exist and a series of intermediate forms. Before assuming self-sterility, however, care must be taken to see that other possibilities such as the effect of the environment on the reproductive organs, the identity of the variety, etc., are considered.
Several cases are mentioned in which different workers, or the same workers in different years, have obtained opposite results.
Intersterility occurs in plums though not so extensively as in the sweet cherries. The self-sterility is, in many cases, only partial and not always reciprocal.

The failure to set fruit cannot be taken as a safe criterion for genetically determined incompatibility nor self-incompatibility. Pollen sterility does not seem to be the result of cytological irregularites, but the apparently normal pollen has a low germination percentage, and it seems that in plums, pollen sterility caused by nutrition factors plays an important part.
Giant pollen grains with the diploid chromosome number have been observed in several varieties but their importance is still in question.
There appears to be at present no possible explanation for the sterility relationships in plums such as has been found for other fruits.
Finally, tests of practical value are given of the self-fertile, self-sterile, and insufficiently self-fertile varieties and of the best pollinators for certain varieties.

165. 634.22:581.162.5
RIETSEMA, I. 634.23:581.162.5
Bestuivingsproeven op kersen en pruimen in 1933. (**Pollination trials with cherries and plums in 1933.**)
Fruitteelt 1934 : **24** : 128–31.
A continuation of the author's observations on the set of flowers and fruit from various crosses, with comments on the value of certain varieties as pollinators.

166. BLAKE, M. A. 634.25–2.111–1.521.6
July report on winter injuries to peach trees.
N.J. St. Hort. Soc. News 1934 : **15** : 625, 630–32.
The varietal factor in winter injury is discussed in the light of observations taken on the resistance of various sorts during 1934.
At New Jersey Experiment Station peach trees from different crosses when exposed to the severe 1934 conditions shewed marked differences in resistance, some being very poor and others (*e.g.* the J. H. Hale x Golden Drop and the Amarillo Tardio x Iron Mountain crosses) displaying outstanding hardiness. In some crosses there was a marked difference between the individual trees as to the amount of twig and wood injury.

167. 634.45
ZARETSKII, A. JA. 634.451
(**The Japanese persimmon.**)
Inst. Pl. Ind. Leningrad 1934 : Sci. Pop. Ser. No. 37 : pp. 54.
Starting with a brief review of the history of its cultivation, which began evidently in China and thence spread to Japan and later to Europe, the author then gives a botanical description of the genus *Diospyros* and the main cultivated species *D. virginiana*, *D. Lotos*, *D. sinensis* and *D. Kaki*.
The area of cultivation of the latter species, the chemical composition and vitamin content and the influence of pollination on fruit and on the yield are all discussed briefly, followed by descriptions of the most important varieties.
The work terminates with short sections on cultivation and utilization.

168. GOULD, H. P. 634.451
Oriental persimmons.
U.S. Dept. Agric. Bur. Pl. Ind. 1933 : pp. 14.
This account of the Japanese or Oriental persimmon *Diospyros Kaki* begins with a brief account of its introduction into U.S.A. and its distribution throughout the country.
The problem of variety identification is discussed and the types of pollination described. Some varieties develop fruit without pollination, others fail to set fruit in its absence, but changes in environment may alter these conditions.
One classification has been arranged by Hume under the two heads, Pollination Constants and Pollination Variants, and another based on the character of the flowers is divided into Pistillate Constants, Staminate Constants and Staminate Sporadics.
The principal varieties available are briefly described and notes on the cultivation of the persimmon are given.
Fourteen papers are cited in the list of relevant literature.

169. UMEN, D. P. 634.58:575(47)
(What has been done in groundnut breeding ?)
Oil crops. Groundnut.
Lenin Acad. Agric. Sci., Inst. Sci. Res. Oil Cult. Krasnodar 1933 : No. 5 : 9–12.

The problems of groundnut breeding in the U.S.S.R. are to select earlier maturing varieties with high yield and oil content and thin shell ; types suitable for oil manufacture and for food are desired, and in each case suitability for mechanized farming is an essential characteristic. To this must be added the further desideratum of resistance to *Fusarium*.

The principal method is the production of pure lines. Hybridization work was begun in 1929 and with the growing amount of initial material available the number of crosses has risen every year. The method of pure line selection has not yielded very favourable results, especially as regards resistance to *Fusarium*, and hybridization is regarded as essential. Some of the pure line selections are proving superior in yield and all have the bushy growth and that firm attachment of the pods to the gynophore, required for mechanized harvesting ; all are, however, susceptible to *Fusarium* attack.

170. UMEN, D. P. 634.58:575.12:578.08
(Technique of artificial hybridization in *Arachis*.)
Oil crops. Groundnut.
Lenin Acad. Agric. Sci., Inst. Sci. Res. Oil Cult. Krasnodar 1933 : No. 5 : 29–33.

Only one flower per inflorescence is pollinated, the rest removed. It has been found desirable to use a flower as near the base of the inflorescence as possible, since in this way the remainder of the axis of the inflorescence may be removed entirely ; there is also more chance of success with the lower than with the upper flowers. If there are flowers below the one used for pollination, these also must be removed.

Labels of parchment or wood have not been a success. The most successful have been zinc labels with an aperture in one corner for attaching it to the plant. These are stamped with a serial number and all the data are recorded in a note book. The labels are wired round the petiole of the leaf so as to enclose also the petiole of the pollinated flower.

Emasculation should be done with fine forceps with blunt points, the best time being the day before flowering, between the hours of 2 and 8 p.m. After emasculation the flower is left till the following day. Preliminary observations have shewn that no bagging is necessary. Pollination is effected when the flowers open on the following day or even before they begin to open, in the early morning. Various methods of applying the pollen are described, all of which have been found equally successful.

In order to be able to treat the plants against *Fusarium* attack and to perform the various operations more conveniently, it is recommended that the experimental plants be grown in pots.

171. UMEN, D. P. 634.58:581.162
(Biology of peanut flowering.)
Lenin Acad. Agric. Sci., Inst. Sci. Res. Oil Cult. Krasnodar 1933 : Sci. Ind. Issue No. 6 : pp. 57.

Before deciding upon the methods of breeding it is essential to have a thorough knowledge of the floral biology of the plant. This is additionally necessary when applying the method of hybridization, which preliminary experiments on pure line selection started in 1926 have shewn to be the only promising method of improvement. In view of this and of the general paucity of literature on the groundnut a study was made of the biology of the plant in general and is published here under the following heads : vegetative organs above ground ; metamorphosis of the vegetative organs ; inflorescence ; flowers ; process of flowering ; flowering of the inflorescence ; flowering of the whole plant ; intensity of flowering ; importance of moisture and temperature for the yield of pods ; dependence of flowering on the relative age ; artificial hybridization.

The descriptions of the various organs are supplemented by illustrations. The section on artificial hybridization is identical with that referred to in Abst. 170 above.

172. KESSELER, E. VON 634.774–2.411.1–1.521.6
A preliminary study of varietal resistance in the pineapple to the root rot fungus *Nematosporangium rhizophthoron.*
Amer. J. Bot. 1934 : **21** : 251–60.
The relative susceptibility of pineapple varieties to the root rot caused by *Nematosporangium rhizophthoron* Sideris was tested by three different methods and the resistance of the varieties under each method is recorded.

173. 634.8:575
Die Rebenzüchtung Pirovanos. (**Pirovano's vine breeding.**)
Das Weinland 1934 : Nos. 1 and 2 : pp. 5.
A short account of the methods and results of the work of the Italian plant breeder with special reference to his work with vines.

174. KOROBEZ, P. V. 634.835:575.25
(Description of new clones evolved in the vineyards of the Annap Zonal Experimental Station.)
Materials on the Investigation of the Clonal Composition of the Vineyards of Northern Caucasus.
Bull. (Trudy) Agric. Inst. Spec. and Tech. Cult. and Annap Zonal Exptl. Sta. Vitic. and Wine 1933 : No. **1** : 5–14.
The present vineyards have become very impure, being infested with low-yielding and in other ways undesirable variants. Descriptions are here given of a number of these variants, to the end that they may be recognized and removed from the plantations. Mention is made only of those points in which they differ from the normal variety, including the germinating power of the pollen and the total yield of fruit.

175. KUSNEZOW, B. G. 634.835:575.25
(Description on the clones of Galan.)
Materials on the Investigation of the Clonal Composition of the Vineyards of Northern Caucasus.
Bull. (Trudy) Agric. Inst. Spec. and Tech. Cult. and Annap Zonal Exptl. Sta. Vitic. and Wine 1933 : No. 1 : 15–26.
A description of the variety and of a number of its clones which are found infesting the vineyards and reducing their yield and quality.

176. RAVAT, J. R. 634.835.09
Les hybrides de la vigne. (**Vine hybrids.**)
Rev. Vitic. Paris 1934 : **80** : 376–82.
A continuation of the paper already noted (see " Plant Breeding Abstracts," Vol. IV, Abst. 1101) giving cultural hints and suggestions for the choice of varieties.

FORESTRY 634.9

177. NIKITIN, I. 634.97:581.331.2:537.531
(The influence of X-rays on the pollen of trees and herbaceous plants.)
Sovietskaja Botanika (Soviet Botany) 1934 : No. 1 : 66–74.
In referring to the remarkable achievements in the production of induced mutations in cultivated plants, the author points out the lack of such investigations in forest trees. Such experiments were begun therefore in 1933.
The germinating capacity of the pollen of some trees in which this is normally low was increased markedly by X-ray treatment, *e.g.* from 12·7 to 40·5 per cent in *Tilia platyphyllus*. The length of the pollen tubes was sometimes increased by as much as seven times. In other trees a retarding effect was observed, *e.g.* in jasmine and *Rosa acicularis*.
Similarly with herbaceous plants, pollen germination in lupin being reduced by X-ray treatment and stimulated in *Colchicum speciosum*.

Experiments on pollen viability shewed that the best method of preserving pollen was over calcium chloride at a temperature of 7–10°C., whereby pollen of *Tilia platyphyllus* was retained for 45 days. The possibility of transporting pollen will facilitate the work of hybridization and make it possible to cross northern with southern forms. The period of pollen viability in jasmine was reduced by X-rays.

178. Al'benskii, A. V. and Delitsina, A. V. 634.972.3:575.12
(Experiment on hybridizing poplars in the laboratory.) Experiments and Investigations.
All-Union Inst. For. Cult. and For. Melioration, Moscow 1934 : 2nd Issue : 107–19.

Branches were cut off from *Populus tremula* and *P. alba* and were induced to flower in Knopp's solution. The course of flowering in the two species is described. Pollen was then transferred from the flowers of one species to the other and the method of effecting this is outlined. The development of the fruit and of the seedlings is also briefly described.
The hybrids, of which 82 were obtained, were very varied in morphological characters and in vigour of growth, including a dwarf group, and a group of very luxuriant growers.

179. Stout, A. B. and Schreiner, E. J. 634.972.3:575.12
Hybrids between the necklace cottonwood and the large-leaved aspen.
J. N.Y. Bot. Gdn. 1934 : **35** : 140–43.

From controlled pollination of *Populus balsamifera virginiana* with *P. grandidentata* 178 seedlings were grown. These hybrids, which are fully described, were very uniform in the general characters of leaves, buds and stems, but they exhibited marked difference in vigour of growth, some being very weak and slow growing. Nearly all the characters of the male parent shewed decided dominance and only in a few characters was there evidence of definite influence of the seed parent.
These hybrids are much less vigorous than hybrids from other crosses within the same genus and appear to be of little practical use.
As far as the authors are aware no previous record of this particular cross exists.

180. Cousins, S. M. 634.972.6:575.127.2:581.44
The comparative anatomy of the stems of *Betula pumila*, *Betula lenta* and the hybrid *Betula Jackii*.
J. Arnold Arb. 1933 : **14** : 351–55.

The hybrid was intermediate in a number of anatomical characters, in others it resembled the pollen parent *B. lenta*.

181. Leliveld, J. A. 634.972.8:576.312:575.127.2
Cytological studies in the genus *Ulmus* L.
I. The supposed hybrid nature of the common Dutch elm.
Genetica 1934 : **15** : 425–32.

A number of species and varieties of *Ulmus* were cytologically examined. No evidence was found in the reduction division of the pollen mother cells of *U. hollandica belgica* Rehd. for the supposed hybrid origin commonly attributed to this species. The chromosomal behaviour was very regular and cannot be regarded as responsible for the sterility found in *U. hollandica belgica* Rehd. A comparison of this species with some related species and varieties shewed no differences in their chromosome configurations.
All species and varieties hitherto investigated have fourteen chromosomes as their haploid number.

182. 635.34:576.312
635.34:576.16

LINDENBEIN, W.

Cytologische Untersuchungen am Markstammkohl. **(Cytological investigations on the marrow stem kale.)**

Züchter 1934 : **6** : 129–36.

This research was undertaken in the hope of elucidating the origin of the marrow stem kale and of establishing its systematic standing.

The course of the reduction division in the pollen mother cell is described. At diakinesis mostly nine bivalents were to be seen but in some cells one to three small, often unpaired, chromosomes occur and in some cells only eight bivalents.

Not only the total number of chromosomes but also the number of univalents and bivalents within one and the same anther are subject to fluctuation. These fluctuations may occur more frequently in some flower buds than in others or may be completely absent.

In the homeotypic metaphase besides the four normal tetrads, one to three micronuclei could be seen in some pollen mother cells, which most likely represent the daughter univalents. The behaviour of the chromosomes in somatic tissue was also investigated and numbers varying between 17–19 were found.

These results are discussed with regard to the possible origin of the marrow stem kale, and it is assumed that non-disjunction in a premeiotic mitosis takes place and a subsequent elimination of the univalents so that the chromosome number of the marrow stem kale is $n = 9$, and can be grouped with *B. oleracea* and it is most probable that the variety in question has originated intraspecifically and can be counted as a variety of the polymorphic *B. oleracea*.

183. 635.52:575.11
635.52:581.162.5
635.55:575.11
635.55:581.162.5

ERNST-SCHWARZENBACH, M.

Zur Genetik und Fertilität von *Lactuca sativa* L. und *Cichorium Endivia* L. **(On the genetics and fertility of *Lactuca sativa* L. and *Cichorium Endivia* L.)**

Arch. Julius Klaus-Stiftung Zürich 1932 : **7** : 1–35.

The small size of the flowers and the fact that emasculation can be performed only when anthesis, which lasts only a few hours, begins represent the main difficulties of technique in crossing lettuces.

The experiments shewed that the fertility of garden lettuce is markedly dependent on the weather. With sunny weather during the blooming period, the self-fertility of 65 cultivated sorts was very high and also the 149 crosses of 47 cultivated sorts of the different varieties of *L. sativa inter se* and 22 species crosses with *L. Scariola* resulted in a high percentage of achenes capable of germination.

The phenotype of the F_1 hybrids was for the most part intermediate, though the still obscure mode of inheritance of the leaf shape of *L. Scariola* var. *typica* proved an exception. In general its lobed shape is dominant but on crossing with *L. sativa* the F_1 exhibited a great variety of leaf shapes.

The capacity for forming a large amount of anthocyanin is dominant to the incapacity for anthocyanin formation. Patrocliny was observed in reciprocal crosses between a vigorous sort rich in anthocyanin and a yellow sort exhibiting weak growth. It is provisionally assumed that the colour differences are traceable to differences in vitality, though the cause of the latter is as yet unknown.

As a mutant from one cross a single constant hybrid appeared which corresponded in all respects with another sort markedly different from the parents of the hybrid.

Of *Cichorium Endivia* 69 sorts were self-fertile ; nevertheless the cross-fertility of *Cichorium Endivia* is considerably less than that of *L. sativa*.

184. MARR, V. E. 635.64:575
Some of the difficulties encountered in tomato breeding.
Trans. Ill. Hort. Soc. 1933: **67**: 412–16.
A very general account of methods used in tomato breeding.

185. LINDSTROM, E. W. 635.64:575.115–181:576.356.5
Segregation of quantitative genes in tetraploid tomato hybrids as evidence for dominance relations of size characters.
Amer. Nat. 1934: **68**: p. 67.
By the decapitation-callus technique it was possible to compare the 2n and 4n progenies arising from the same F_1 plant. Using the most fertile tetraploid—from the cross of the wild *Lycopersicum pimpinellifolium* by the domesticated *L. esculentum*—examination of the 4n and 2n F_2 progenies proved that the 2n distribution possessed a significantly larger standard deviation and coefficient of variability. While the modes of the two curves were identical, the mean of the 2n F_2 was significantly larger, resulting in a typical skewed (positive) curve for the 2n material and a nearly normal curve for the 4n progeny. This is interpreted to mean a dominance of the small, fruit-size genes instead of a geometric effect of such genes, despite the fact that the 2n F_2 distribution when plotted logarithmically approaches a normal curve. The skewness of the diploid F_2 accordingly is caused by the emergence of the recessive, large-size genes which do not emerge with such frequency in the 4n progeny. Even with maximum chromatid segregation only 4·6 per cent recessives appear for a single tetrasomic set of chromosomes. If universal, this dominance bias is a critical example of the recessive nature of size genes in domesticated forms in contrast to the dominance of their wild allelomorphs.

186. MACARTHUR, J. W. 635.64:575.243:537.531
X-ray mutations in the tomato.
J. Hered. 1934: **25**: 75–78.
After X-ray treatment of tomato seeds the percentage germination was high and nearly equal (95 per cent) in the control and the irradiated seeds.
In 346 progenies 43 mutations were found, one progeny exhibiting two mutations. The number of mutations induced was clearly related to the X-ray dosage, for a 60′ exposure caused 15·9 per cent mutations and a 46½′ exposure 8·3 per cent. Germination and fertility remained normal in both the X_1 and X_2 generations, and it seems possible that gene mutations are relatively more frequent with moderate and sub-lethal doses.
The changes induced which were most varied and affected foliage and stem colour, leaf shape, stature, branching habit and growth rate are described. In general they were all recessive and monofactorial and probably chiefly point mutations. More than half were lethals and others were semi-lethal and only about twelve out of the total could be cultivated regularly in the pure state. All the mutants but a few are slow growing, weak or stunted and shew deficient numbers in F_2 or back-cross generations, but surprisingly few are sterile or semi-sterile. About 25 of the most viable or most distinct types have been selected for cytogenetic study of the pollen, chromosomes and linkage, and those of ultimate genetic value will be further described and named.

187. 635.648:575.127.2:575.11
TESHIMA, T. 635.648:575.127.2:576.312
Genetical and cytological studies on an interspecific hybrid of *Hibiscus esculentus* L. and *Hibiscus Manihot* L.
J. Fac. Agric. Hokkaido Univ. 1933: **34**: Pt. I: pp. 155.
Crosses were made between *H. esculentus* L. with 36n chromosomes and *H. Manihot* with 30n. The cross only succeeded when *H. esculentus* was used as the female parent, the reciprocal produced only abortive seeds.
A study of the possible causes of this difference shewed that it was not dependent on the rate of pollen tube growth and the author inclines to the view that the cytoplasm plays an important part.

The morphological and physiological features of the F_1 hybrid are described in detail and compared with those of their parents. The fertility of the F_1 hybrid was less than one per cent but a number of seeds were obtained by using the pollen of *H. esculentus* on the F_1 hybrids. The reciprocal *H. esculentus* cross was not successful. A morphological description is given of these back-crossed plants.
The second part of the paper deals with the cytology of the hybrids. Meiosis was very irregular and no bivalents were observed but giant pollen grains and other abnormalities occurred.
Constant types were obtained by open pollination of the back-crossed plants.

188. PARKER, M. C. 635.652:575.182.061.633
Inheritance of a leaf variegation in the common bean.
J. Hered. 1934: **25**: 165–70.
In investigating the chlorophyll deficiency, termed " variegated," in the bean, the author claims to have discovered direct evidence of inheritance through the cytoplasm.
From the F_1, F_2 and reciprocal crosses between chlorophyll deficient and normal plants of the Pencil Pod Black Wax variety the variegated character " appears to be inherited independently of nuclear factors." The author believes the results can be best explained by assuming that the cytoplasm is instrumental in transmitting the variegated character, though it is impossible to determine with certainty whether constituents of the cytoplasm are responsible for the transmission or whether the cytoplasm itself is capable of causing such an effect. In any event the instance " may be considered as a case of biparental cytoplasmic inheritance."

189. FRETS, G. P. and WANROOY, G. 635.652:575.22–18
Die Erblichkeit der Bohnenform und des Bohnengewichtes bei *Phaseolus vulgaris.*
I. Die geselbsteten Linien.
(The inheritance of shape and weight of the bean in *Phaseolus vulgaris.* I. The selfed lines.)
Genetica 1934: **16**: 45–76.
A study was made of two pure lines, one of which had been selfed for five generations, the other being Johannsen's original O line continuously selfed. Measurements were made of the length, breadth, thickness and weight and also the indices of length to breadth, length to thickness and breadth to thickness, in the beans of the original populations and of their selfed progeny. The agreement between the two was good and indicated that no selection had taken place. The standard deviations of the three dimensions were all more or less equal; that for the weight was somewhat higher. The standard deviations for the indices were definitely smaller, shewing that these indices are therefore good characters for study. The value of the indices varies to a certain extent with the value of the particular dimension, *e.g.* the length to breadth index $\frac{(100B)}{L}$ is less in the larger beans than in the small. In general there is a tendency for an increase in one dimension (*e.g.* length) to be associated with relative reduction in the others (breadth and thickness). In the light of the established purity of the lines this is seen to be not a genetic relationship but physiological, an example of Johannsen's " compensational growth."

190. 635.652:575.42"793"
GARVER, S. 635.652 Redfield
The Redfield tepary bean, an early maturing variety.
J. Amer. Soc. Agron. 1934: **26**: 397–403.
The Redfield tepary bean (*Phaseolus acutifolius*, Gray, var. *latifolius*, Freem.) which has been evolved by mass selection during 1914–1920 from a Texas tepary T.S. 3306, a southern white-seeded variety, matures at least two weeks earlier than the parent stock and has white seeds with a greenish tinge. The seeds mature from late August until frost injury sets in. Well developed pods contain 6–7 seeds, the size and plumpness of the latter depending on the seasonal conditions and especially the July and August rainfall and temperatures.
Its uses are described.

191. CHMELAŘ, F. and MOSTOVOJ, K. 635.655:581.142:581.035
Rychlé rozlišování sort soje a druhů jetelů podle liminescence makličených zrn. (**A rapid method of distinguishing soya bean varieties and clover species by the luminescence of germinated seeds.**)
Věst. (Bull.) Českoslov. Akad. Zeměd. 1934 : **10** : 289–95.
Luminescence of soya bean seedlings proved to be a good varietal character, the whole of the tissue of some varieties sending out a strong blue light, while other varieties with the same form and colour of seeds do not possess this property.
The technique is described.

192. CUTLER, G. H. 635.655:581.48:578.081
A simple soybean seed counter.
J. Amer. Soc. Agron. 1934 : **26** : 75–76.
A rapid, accurate and simple mechanical counter that has been devised for any soya bean tests involving seed counting is illustrated and described. Tests have shewn that using this appliance seeds can be counted ten times as fast as the rate of the average worker unaided.

193. WEATHERSPOON, J. H. and WENTZ, J. B. 635.655–1.557:519.241.1
A statistical analysis of yield factors in soybeans.
J. Amer. Soc. Agron. 1934 : **26** : 524–31.
Two hundred and thirty seven strains of soya beans selected from the bulked progeny of an F_3 plant of a cross between Soysota and Ogemaw were tested for correlations of a number of characters with yield.
The method of analysis of variance was first applied to test the variations of the characters to be tested and it was found that in spite of the genetical relationship between the strains they differed sufficiently with respect to yield and other characters to provide suitable material for the experiments.
Number of pods, number of nodes, number of pods per node and height were significantly and simply correlated with yield. Seed size was positively correlated with the percentage of abortive seeds and negatively correlated with number of pods, number of nodes and height, which suggests that a physiological relationship, probably nutritional, is involved and the chance of producing a plant with large seeds, low percentage of aborted seeds, large numbers of pods and nodes and of great height is unlikely.
A multiple correlation coefficient of 0·5822 was found between yield and the factors height, number of nodes, number of pods, percentage of abortive seeds and seed size.
The data indicate that for the estimation of yield the most important factors are height of plant and number of pods per plant.

194. BOURDOUIL, C. 635.656:575:581.461
Sur quelques anomalies héréditaires de la fleur de *Pisum sativum* L. (**On some hereditary anomalies of the flower of *Pisum sativum* L.**)
Bull. Soc. Bot. Fr. 1933 : **80** : 831–33.
The anomaly which affects the corolla, calyx and stamens was first observed in 1931 in two plants which displayed an asymmetric arrangement of the floral leaves and also had a peculiar toothed collaret structure surrounding the petiole. The anomalous formations which have been retained throughout three generations of cultivation are described in detail.

195. HAAN, H. DE 635.656:575.113.42
Gibt es polymere Faktoren? (**Do polymeric factors exist?**)
Genetica 1934 : **15** : 529–43.
Observations were made on 235 F_3 cultures and a total of 66,770 *Pisum sativum* plants derived from a cross of two dwarf forms are regarded as demonstrating conclusively the existence of two polymeric growth inhibiting factors for stem length.
The agreement between the observed ratios and the linkage relations affords the proof that the character in question is polymerically conditioned and definitely excludes any possibility of multiple allelomorph action as an explanation in this particular instance.

196. RASMUSSON, J. 635.656:575.116.1:575.114.4
Genetically changed linkage values in *Pisum*. II. Segregation of linkage intensity in crosses.
Hereditas 1934 : **19** : 323-40.

Some years ago the author demonstrated that in *Pisum* the factors *Le* (internode length) and *V* (for pod membrane) gave strikingly different recombination values in different crosses. Working with plants of the same pure lines used in 1927 or derivatives of crosses between those lines the behaviour of the factors *Le* and *V* were observed in suitable crosses. The wide range of variation revealed in linkage intensity suggested that after each cross a segregation in linkage determining factors had occurred in the F_1 and F_2 plants of the pure line and in some cases even in the gametes of the F_3 plant.

Though the genic nature of the variation in linkage is regarded as proved beyond any doubt, the question of the number of factors involved still presents many difficulties, since the assumption of an underlying quantitative segregation (which the author tends to regard as the most plausible genetic interpretation) does not fully agree with the facts. Structural differences between the chromosomes of different biotypes is another possible explanation.

Suggestions are made for further lines of research and material is offered to any geneticists who might like to contribute to the solution of the problem.

197. HÅKANSSON, A. 635.656:576.356.2:581.162.5
Chromosomenbindungen in einigen Kreuzungen zwischen halbsterilen Erbsen. **(Chromosome configurations in some crosses between semi-sterile peas.)**
Hereditas 1934 : **19** : 341–58.

Previous cases of chromosome changes connected with semi-sterility in *Pisum* are cited, three of these being " prime types " (as defined by Bergner, Satina, and Blakeslee, 1933) and the rest segregating out such prime types, for fertile and semi-sterile plants are found in their progeny in equal numbers or in a ratio of 2 : 1 normal (see " Plant Breeding Abstracts," Vol. III, Abst. 549).

Four such semi-sterile types and one prime type were used as material for crossing to determine whether the same or different chromosomes were affected by the processes of chromosomal exchange between non-homologous chromosomes that occurs in the formation of such semi-sterile and prime types.

From most of the crosses plants were obtained with a new chromosome configuration that was composed of either two fours or one six and had not been present in the parent plants. One cross alone gave only two types of plants, fertile with normal chromosome pairing and semi-sterile with an amphibivalent and five bivalents—all indications that in the two parent plants the same chromosomes had been affected by the segmental interchange.

Increased sterility was noted in plants with the larger chromosome configuration consisting of six paired chromosomes, approximately three-quarters of their pollen being sterile.

198. 635.656–2.7–1.521.6
RUDORF, W. 635.656:581.162.32
Beobachtungen über den Befall mit dem Erbsenkäfer (*Bruchus pisorum* L.) und über die Befruchtungsverhältnisse an Erbsensorten in Santa Catalina (Argentinien). **[Observations on the attack of the pea beetle (*Bruchus pisorum* L.) and on the pollination behaviour in varieties of peas in Santa Catalina (Argentine).]**
Pflanzenbau 1934 : **10** : 465–71.

The varieties are grouped according to their time of flowering and the percentage of attack is determined, from which it emerges that in general early flowering protects the varieties concerned from excessive damage and that conversely the late flowering varieties are more susceptible to attack.

The habits of the insect must however also be taken into consideration and those varieties that flower before or after the time for the deposition of the eggs must not necessarily be regarded as immune or resistant.
The amount of cross-pollination was determined in a number of varieties and found to vary between 0·2 per cent and 6·4 per cent except for two varieties, Bountiful and Kentish Invicta which gave the surprising figures of 32·0 per cent and 24·5 per cent respectively.
Taking into account that the varieties used were not pure lines and the average percentage of varying grain types cannot be shewn to agree with the occurring cross-fertilization it is clear that *Pisum sativum* under the conditions in the Argentine is not mainly self-fertilized.

BOOK REVIEWS

DANTCHAKOFF, V. 577.81
Le devenir du sexe. **(Sex differentiation.)**
Hermann and Cie, Paris, 1933: 15 fr. Pp. 60.
From experiments already made on animals the author draws the conclusion that neither the germ cells nor the cells of the gonadic epithelium which surrounds them, alone determines the sex of the germ cells but sex differentiation is brought about by the interaction between the two types of cells.

HOLMAN, R. M. and ROBBINS, W. W. 58
A textbook of general botany for colleges and universities.
John Wiley & Sons, Inc., New York, 1934: 25*s*. Pp. xv. × 626: 463 illus.
In the third edition of this textbook of elementary botany the information has been brought up to date and the book enlarged by many additional illustrations. Intended for the use not only of students without any knowledge of botany but also for agricultural students beginning botany, the book stresses wherever possible the practical application of the facts.
Part I deals with the structure and physiology of angiosperms and Part II with a survey of the plant kingdom and includes a chapter mainly on evolution and heredity which treats of Darwin's theory of evolution and Mendel's experiments but does not touch upon the modern developments or the practical aspect of the subject.

582(014)
Standardized plant names. A catalogue of approved scientific and common names of plants in American commerce.
Amer. Joint Cttee. Hortl. Nomencl. Salem, Mass 1924: 25*s*. Pp. xvi × 546.
This book represents the decisions reached by the American Joint Committee on Horticultural-Nomenclature instituted to bring about as far as possible the use of a single standardized " scientific " name and a single standardized " common " name for every tree, shrub and plant in American commerce. In addition to its main task the Committee dealt with questions of orthography, synonyms and names for horticultural hybrids. A number of vegetables such as cabbage, celery, potatoes, etc., flowering annuals and bulbous plants have been reserved for future deliberations which will also include the registration and identification of varieties, etc., and a nomenclature code.
The names published as standardized were declared to be so for not less than 5 years when revision will be considered.
The abbreviations used in citing authorities and plant names that have already occurred in full and the system of distinctive types, to which a key is given at repeated intervals throughout the book, have resulted in a compact volume which is also easy to use. It should be of value to workers requiring information on standard names or the elucidation of synonyms or names of plants not approved in horticultural use in America.

STRILCIUC, D. 633:581.8

Mikrophotographischer Atlas der Zerealien einschliesslich Hirsen und Buchweizen sowie der wichtigsten Leguminosen. (**Microphotographic guide to the cereals, including millets and buckwheat, and to the main leguminous plants.**)

Verlag der Z.ges. Getreide–u.Mühlenw. 1932 : No. 10 : Pp. 12. 284 illus.

The work consists of a series of beautiful microphotographs of the various tissues of the grain of all the main cereals, under different magnifications and treatments, and of their starch grains. The millets and buckwheat are included among the cereals and there follows a set of similar photographs for the main leguminous food plants, including peas, beans, lentil, gram, soya and lupins.

The book is intended for use as a reference work for all those dealing with plant histology, including botanists and technicians requiring to detect the composition of a flour.

The introductory section describes the methods used in making the preparations.

HARLER, C. R. 633.72

The culture and marketing of tea.

Humphrey Milford, Oxford University Press, London, 1933 : 12*s*. 6*d*. Pp. xi + 389. 8 illus.

Written mainly for the tea planter with special reference to North East India where the author has worked for fourteen years, this book deals simply with the main facts necessary to anyone concerned with the cultivation of tea and also of interest to the general reader.

The work is divided into four parts comprising : (1) a general description of the tea plant in tea production, (2) the chemistry and pharmacology of tea, (3) accounts of the tea industry in the tea countries of the world and (4) the British tea trade.

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